

HYQUAL
Water Quality Database
Version 1.0
Operation Manual

October 1993



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1. INTRODUCTION

1.1 Structure of the manual

The HYQUAL manual is divided into eight sections. Section 1 (this section) describes the manual and gives an overview of HYQUAL.

Section 2 provides a simple tutorial for users who are unfamiliar with Microsoft Windows. This section is not regarded as a substitute for a thorough understanding of Windows. The section also describes how to install HYQUAL through the Windows interface.

Section 3 explains, with tutorial examples, all of the major features of HYQUAL. It particularly concentrates on the entering of data into HYQUAL.

Section 4 amplifies the previous section in respect of the HYQUAL database structure and data entry.

Sections 5 and 6 describe tabular and graphical output respectively.

Section 7 deals with file import and export.

Section 8 describes the system manger program and password usage.

1.2 Conventions used in the manual

Keys on the computer keyboard are indicated by the name of the key inside angle brackets. For example, the key marked F1 on the keyboard is represented in the manual by <F1>. The Enter key is indicated by <Enter>. Sometimes it is necessary to press a combination of two keys together and this is indicated by, for example, <Alt-I>, which means hold down the <Alt> key and simultaneously press the <I> key.

HYQUAL is controlled by selecting choices from menus displayed on the screen. Menu choices are indicated in the manual by square brackets, e.g. [Input]. (Note: menu selections will usually be made with a mouse, but they may also be made by typing the letter that has been underlined in the menu choices.)

Any input that the user is required to type is represented by bold characters. For example, to start the HYQUAL program the user can type **HYQUAL** <Enter>.

Throughout this manual it has been assumed that the software is being installed on a personal computer with a floppy disk drive A and a hard disk drive C. The user should substitute the correct drive letters if other disk drives are being used. It is also assumed that the Windows software has already been installed and configured for the system.

When disk drives and disk directories are mentioned, the drive letter will be followed by a colon and the directory will be preceded by a back-slash (\), e.g. C:\HYQUAL refers to a directory called HYQUAL on disk drive C.

1.3 HYQUAL hardware requirements

HYQUAL requires an IBM (or compatible) personal computer with a 386 or 486 processor, at least 2Mb of memory (4Mb is recommended), a hard disk drive with at least 5Mb of free storage space, and a VGA graphics card and monitor (colour recommended). Microsoft Windows needs to be installed on the computer before HYQUAL can be run. Although most Windows functions can be operated by keyboard commands, a mouse is required to obtain the full benefit of the system.

1.4 HYQUAL overview

HYQUAL is a water quality database for IBM and compatible personal computers running under Windows Version 3.0 or 3.1. It is designed to facilitate the storage of water quality information and analysis of the data with the help of tabular and graphical reports. The tables and graphs are extremely flexible and provide a useful tool for data verification and as the basis for inputs to modelling studies.

HYQUAL uses a hierarchical structure to store information. This is based on the following building blocks:

DETERMINAND → SAMPLE → SAMPLING POINT → CLUSTER → REGION

Information for any number of determinands can be stored for a sample at a particular sampling point. Sample types may be defined as standard sets of determinands appropriate for routine sampling. Any sampling point may be grouped with other related sampling points (for example, those on a reservoir or in a sewage works) into "clusters" and the clusters grouped into regions. The regions, clusters and sampling points are referred to by a reference code defined by the user. There is also a facility to store a longer descriptive name for each code. Additional information for sampling points may be included, for example, grid reference, the type of sample, the names of the sampler and the analyst, and laboratory information.

HYQUAL can be set up to provide standard determinand dictionaries for chemistry, microbiology, hydrology, sewage disposal, water supply and biology.

Information, once stored, can be accessed and used to produce tables of information or graphic plots. These reports can be used as powerful tools for data verification and as a first step to analysis.

2. AN INTRODUCTION TO WINDOWS

2.1 The Windows graphical user interface

HYQUAL has been written to operate under the Windows graphical user interface (GUI). Users should refer to the manual(s) supplied with their Windows software for a complete explanation of operations in the Windows environment. This section of the HYQUAL manual is intended to provide sufficient information to allow users to work with HYQUAL and Windows straight away.

When Windows is running, the computer screen (called the desktop in Windows) contains a collection of menus, graphic symbols (icons) and frames (windows). Programs are run "inside" a window and several windows may be open, each running a different program. The windows can be re-sized, moved around the desktop, or closed down. Every icon and window frame has a title, or label. Throughout the manual these labels are indicated by the use of italic letters (e.g. *Program Manager*). Windows version 3.0 and version 3.1 differ slightly in appearance.

The Windows environment was designed to be used with a mouse, or similar pointing device, although many functions can be performed through the keyboard. Throughout this manual the use of a mouse is assumed but, where appropriate, keyboard alternatives are given. When the manual indicates that the user should "click" on an object on the Windows desktop, it means that the mouse pointer should be placed on the object and the left mouse button should be pressed once and quickly released. Some Windows functions can be performed by clicking twice in rapid succession on the left mouse button. The manual will indicate this by asking the user to double click.

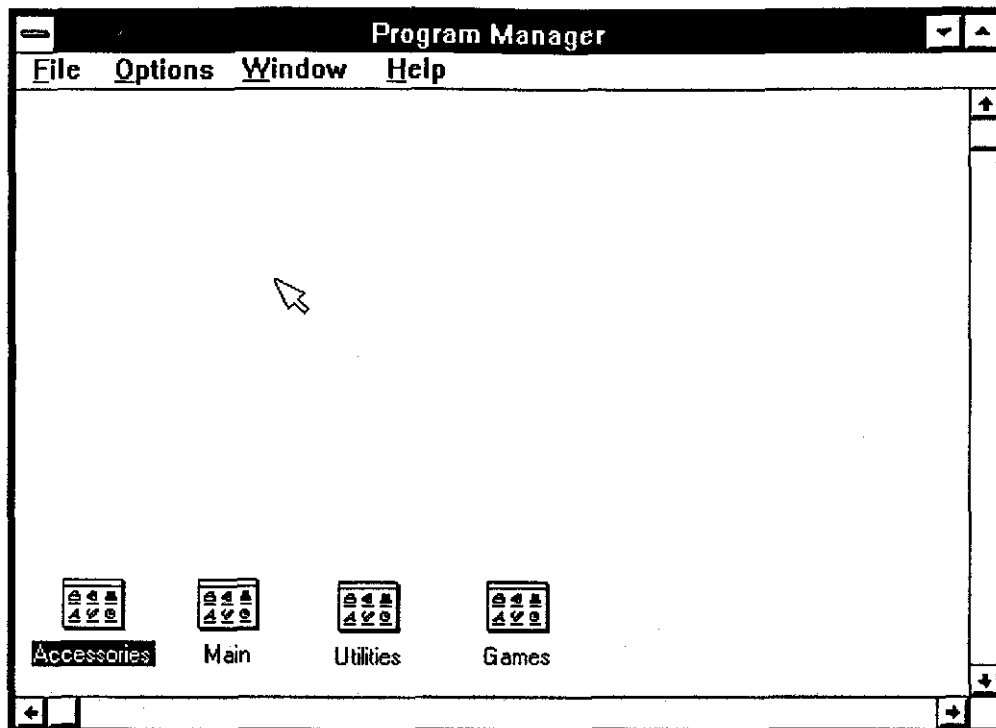
2.2 Starting Windows

To start Windows from DOS type WIN <Enter>. The program will take a few seconds to load but eventually the Windows "desktop" will be displayed.

Figure 2.1 shows a typical Windows desktop configuration. The exact appearance of the Windows desktop will vary depending upon how it has been set up. The Windows "desktop" is simply the computer screen and all of the graphical elements that appear on it. In the Windows environment, programs are run in boxes, or frames, known as windows. Several windows can appear on the desktop at the same time, each one having a different program running within it. Each window is labelled at the top with the name of the program running inside the window. The size of each window can be altered and they can overlap or sit side by side. Windows can be opened and closed as needed and they can also be reduced to icons on the desktop, ready to be called instantly into action again.

Windows makes use of special window frames called dialog boxes for entering data and issuing program commands. In this manual all window frames have their titles printed in italic letters, e.g. *Program Manager*.

The example of a Windows desktop shown in figure 2.1 gives a typical example. It has a single window frame at the centre of the screen. The window has four graphic symbols, or icons, towards the bottom of it, and there is a fifth icon at the bottom left of the screen, outside of the window. The small arrow near the centre of the screen is the mouse pointer which will only be present if a mouse is installed.




 WordPerfect -
 [c:\wpdocs\hyqual.doc]

Figure 2.1

2.3 Icons, windows and menus

After Windows has been started from DOS the *Program Manager* window should be displayed. The *Program Manager* is simply a utility used by Windows for organising all of the other programs in the Windows system. The next few paragraphs use the *Program Manager* window to explain some of the features of the Windows graphic environment.

All window frames can be re-sized by using the mouse. To try this, move the mouse pointer anywhere over the *Program Manager* frame border until the shape of the pointer changes to a double-ended arrow, then, while holding down the left mouse button, drag the frame border to a new position and then release the mouse button. Repeat this process with the other frame borders until the window is the required size. The whole window can be moved to a different location on the desktop by placing the mouse pointer anywhere in the coloured bar containing the window title (i.e. the area at the top of the window frame containing the title "*Program Manager*") then, while holding down the left mouse button, dragging the entire window to a new position on the screen. Releasing the mouse button will fix the window in its new position.

If the window has been re-sized so that all of the items (icons, etc.) contained in the window are no longer visible, "scroll bars" will appear at the right and/or the bottom of the window frame (see figure2.1). Each scroll bar has an arrow at each end and a square "button" positioned somewhere in the scroll bar between these two arrows. To scroll the window in small increments click on the scroll bar arrows. The window can be made to scroll in larger increments by clicking anywhere inside the scroll bar, except on the square "button". The scroll bar button is used to make large scrolling movements by placing the mouse pointer on it and, while holding the left mouse button down, dragging the button along the length of the scroll bar.

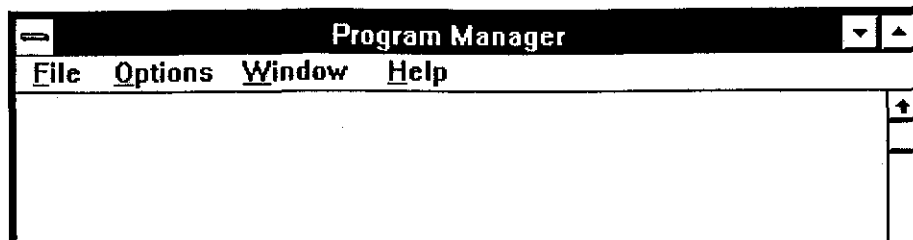


Figure 2.2

Figure 2.2 shows the top part of the *Program Manager* window. The window title bar has buttons at either end of it. There are two buttons on the right, marked with triangles, one pointing up and one down. Clicking on the one marked with the triangle pointing upwards will cause the window to expand to fill all of the desktop. The triangle symbol will be replaced by a double arrow-head symbol which is used to restore the window to its original size. Clicking on the button with the downwards pointing triangle symbol will cause the window to be reduced to an icon at the bottom of the desktop, as shown in figure 2.3.

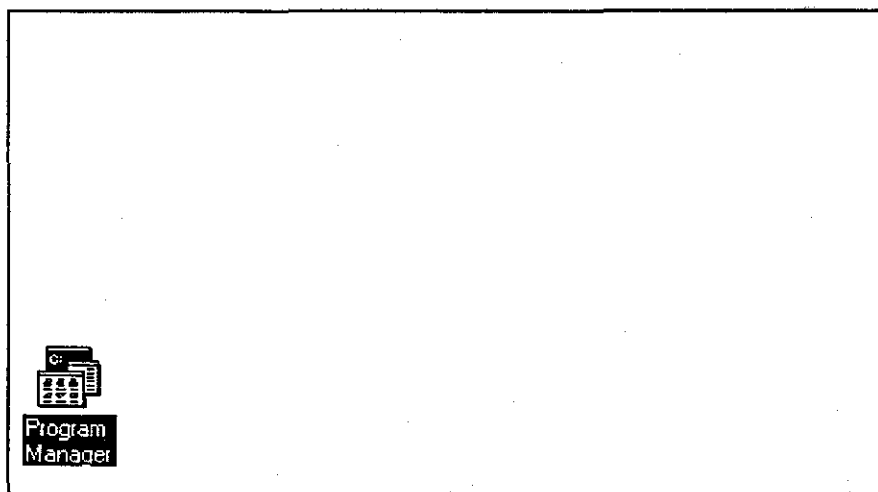


Figure 2.3

To restore the icon to an open window, click anywhere on the icon. A menu of choices will pop up over the icon, as shown in figure 2.4. Click with the left mouse button anywhere on the menu choice marked [Restore], or type **R** on the keyboard.

All menu items in Windows can be selected by either clicking on them with the left mouse button, or by typing the letter that is underlined in each choice. A third way is to use the up and down arrow keys on the keyboard until the required choice is highlighted by the coloured light-bar and then pressing the <Enter> key. Some menu choices have a key combination to use as a short cut, e.g. <Alt-F4> can be used to [Close] the currently active window without using the menu.

The menu choices shown in figure 2.4 are standard ones which will appear over most icons in Windows. [Restore] restores the window to its former size. [Move] allows the icon to be moved to a different position on the screen. [Size] allows an open window to be re-sized using the keyboard arrows instead of the mouse. [Minimize] reduces an open window to an icon. The [Minimize] and [Size] options will be "greyed-out" in this example, i.e. they will appear in faded letters to indicate that the option is not a valid choice in this instance (the window is already reduced to an icon). [Maximize] expands the icon into a full screen window occupying all of the Windows desktop. Remember that icons

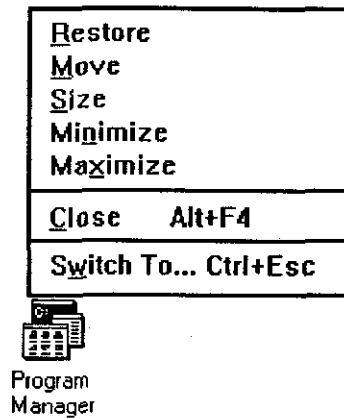


Figure 2.4

represent programs running on the Windows desktop; the [Close] option terminates the running of the program and clears the icon from the desktop. The [Switch to...] option displays a list of programs currently running on the Windows desktop, and allows the user to switch to a different task by clicking on the task name. To clear the menu without making a selection press the <Esc> key on the keyboard, or click on any clear area of the desktop. Pressing the <Esc> key or clicking on a blank part of the desktop is the usual method of cancelling an action in Windows.

Referring back to figure 2.2, there is another button, with a horizontal bar as a symbol, on the left side of the *Program Manager* window title. Clicking on this reveals a menu similar to the one just described.

Immediately beneath the *Program Manager* window title there is another bar with a list of menu choices (see figure 2.2). For the *Program Manager* these choices are [File], [Options], [Window] and [Help], but menu choices will be different for each Windows program. Clicking on a menu choice causes a sub-menu to drop down. Choices from sub-menus are also made by clicking on them. Some sub-menu choices have an ellipsis symbol against them [...], which indicates that a further sub-menu will appear if this choice is selected. Clicking anywhere outside of the menu box, or pressing the <Esc> key, will cause it to disappear.

Menu selections can also be made through the keyboard. To access the menu first tap the <Alt> key. One of the menu selections will become highlighted but be aware that the highlighted selection could be one of the buttons at either end of the window title bar. To cycle through the menu selections (and buttons) use the left and right arrow keys on the keyboard. When the required choice is highlighted, press the <Enter> key. Sub-menus choices can be made by moving the highlight bar with the up and down arrow keys and pressing <Enter>.

The methods of manipulating windows and icons described above are common to all Windows programs. More information is contained in the manuals supplied with the Windows program.

2.4 Installing HYQUAL through the Windows Program Manager

The *Program Manager* is itself a Windows program. It is used to "launch", or start, other Windows programs. In figure 2.1 on page 4, the *Program Manager* window has four icons shown in it. In this example the icons are labelled *Accessories*, *Main*, *Utilities*, and *Games*. Each of these icons represents a group of programs. Click on any one of the program group

icons to display a menu, then on either the [Restore] or [Maximize] option of the menu. A new window will appear and it should contain icons representing each of the programs in the group. Click on the downward pointing triangle symbol to close the window again. (Note: double clicking on icons provides a short cut to open them without going through menus.)

Users may group programs together in any manner that seems appropriate. This section of the manual shows how to create a new program group into which HYQUAL may be installed.

Click on the menu option labelled [File] in the *Program Manager* window, then on [New] in the sub-menu. A small window titled *New Program Object* should open, similar to the one shown in figure 2.5. This type of window, which allows the user to issue commands by clicking on a "command button" ([OK], [Cancel] or [Help] in figure 2.5), or an "option button" ([Program Group] and [Program Item] in figure 2.5), is called a dialog box.

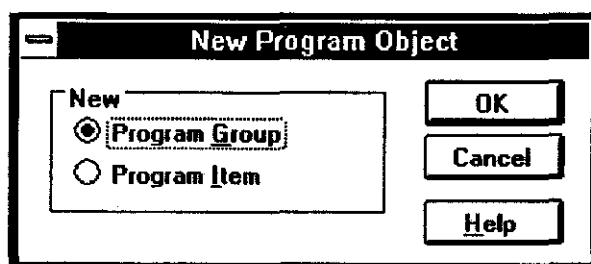


Figure 2.5

Click on the option button called [Program Group] then on the [OK] button. A new dialog box called *Program Group Properties* will open. This has two blank "text boxes" which both need to have entries typed into them (figure 2.6).

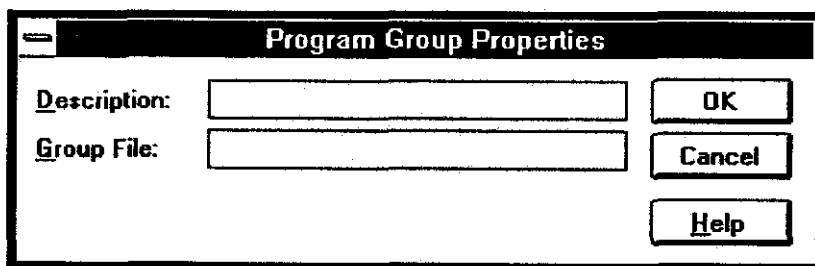


Figure 2.6

The [Description] text box is used to enter a title. This is the title that will appear on both the program group icon and in the title bar of the window when the program group window is open. The [Group File] text box is used to enter the name of the DOS file in which the details about the program group will be stored. To set up a program group ready for installing HYQUAL, type **Hydrological Software** into the [Description] text box then press the <Tab> key on the keyboard to move the windows cursor to the [Group File] text box (or click anywhere inside the [Group File] text box). Type **HYDRO** as the group file name. Different description and group file names may be used if required. To finish the creation of the new program group click on the [OK] box, or tap the <Tab> key until the [OK] box is highlighted and then press the <Enter> key.

The new, blank program group window will open and the HYQUAL program can be installed into it as an icon. The HYQUAL package must first be copied from the original floppy disk onto the computer's hard disk. To do this first click on the [File] option of the menu at the top of the *Program Manager* window (or type F), then click on the [Run] option of the sub-menu that appears (or press R). A *Run* dialog box appears as shown in figure 2.7.

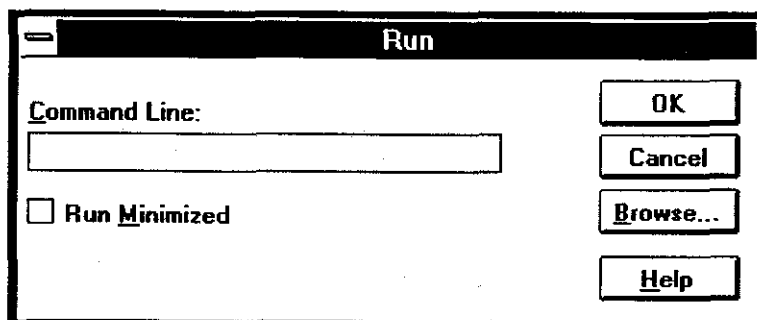


Figure 2.7

Put the original HYQUAL distribution disk in drive A, type `A:\HQINSTAL A: C:` into the [Command Line] box and click on the [OK] button. The HYQUAL installation routine will create a sub-directory called `C:\HYQUAL` on the hard disk and copy the program files into it. If you are using disk drives other than A and C, substitute the correct letters in the command. During installation, the HYQUAL System Manager program will automatically run and will call for a password, as described in section 8.

The final part of the installation process is to place a HYQUAL program icon into the program group window that has been created previously. Click on the [File] option on the *Program Manager* Window then on the [New] option on the sub-menu. Select [Program Item] from the dialog box and click on the [OK] button. A new dialog box will appear, as shown in figure 2.8.

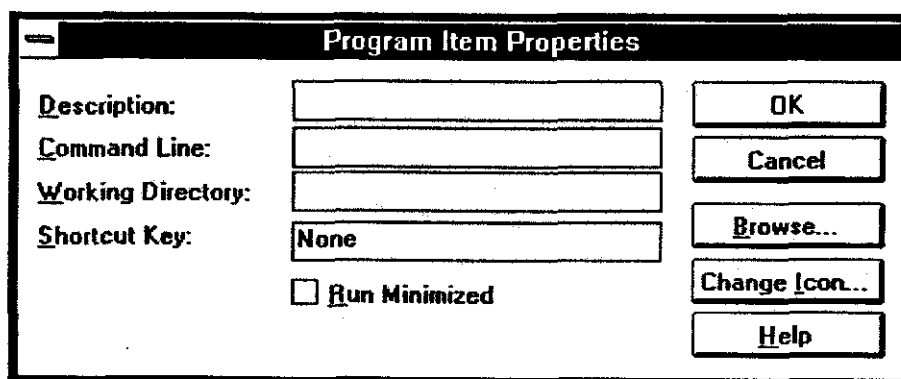


Figure 2.8

Type **HYQUAL** into the [Description] box, then `C:\HYQUAL\HYQUAL.EXE` into the [Command Line] box (press the <Tab> key or click inside the box to move the cursor into it) and `C:\HYQUAL` into the [Working Directory] box (Windows version 3.1 only). Finally, click on the [OK] button. HYQUAL will be installed as an icon in the *Hydrological Software* program group window, as shown in figure 9.

Except for the addition of a system manager password, HYQUAL is now ready for running by double clicking on the *HYQUAL* icon. For information on the system manager password see section 8.

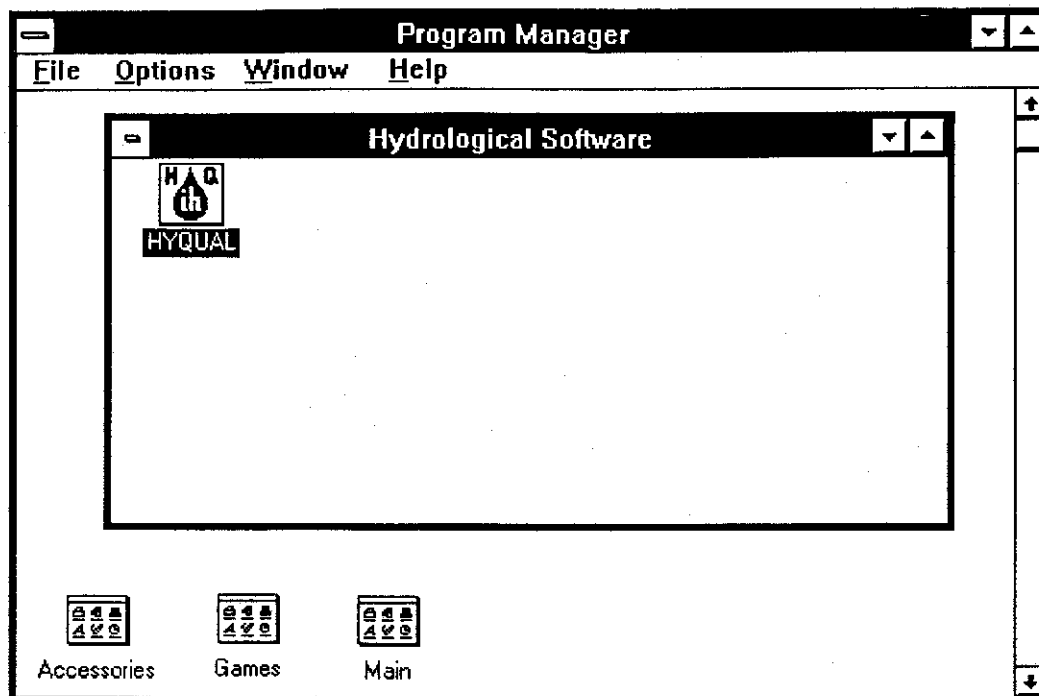


Figure 2.9

2.5 The Windows Control Panel

Windows is provided with a large number of printer drivers, and special Windows drivers are sometimes also supplied with new printers. Users may need to print hard copy output from HYQUAL to more than one printer device. For example, tabular output could be sent to a standard printer and graphs to a plotter, or to a colour inkjet printer. All of the devices which are going to be used must be installed in the Windows environment. This can be done through the *Windows Control Panel*. The *Control Panel* is a program containing utilities that are used to customise the Windows environment. When Windows is installed, the *Control Panel* is placed in the program group called *Main*. From the *Program Manager* double click on the *Main* program group icon, then on the *Control Panel* icon in the *Main* program group window. The *Control Panel* utilities are represented by icons, one of which is labelled *Printers*. This utility is used to install and configure new printer drivers and to select the currently active printer (see figure 2.10).

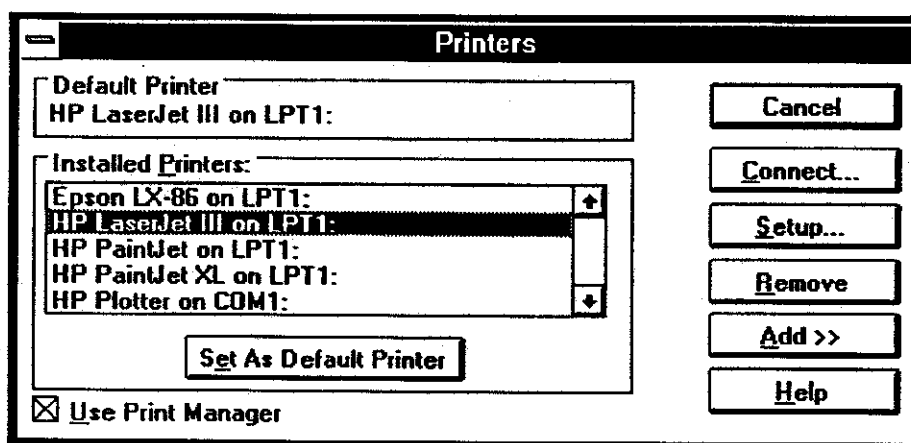


Figure 2.10

To see how this works, double click on the *Printer* icon. A list of installed printers will be displayed. If the list of installed printers is large, a scroll bar will also appear so that the list can be scrolled up and down. Double click on the required printer to make it the default printer (or click once on the printer name and then on the [Set As Default Printer] button). All hard-copy output from HYQUAL (and other Windows programs) will now be directed to the selected device.

Users who regularly use more than one printer with HYQUAL may find it convenient to install a copy of *Control Panel* into the *Hydrological Software* program group. To do this, open both the *Main* and the *Hydrological Software* program groups and arrange the window frames so that both can be easily seen (a quick way to arrange window frames in this manner is to press <Shift-F4> or else to select [Window] from the *Program Manager* menu and then [Tile] from the sub-menu). Click on the *Control Panel* icon in the *Main* program group window and then, while simultaneously pressing both the <Ctrl> key on the keyboard and the left mouse button, "drag" the *Control Panel* icon into the *Hydrological Software* program group window. When the <Ctrl> key and mouse button are released, a copy of the *Control Panel* will be made in the *Hydrological Software* program group window.

3. QUICK START TO USING HYQUAL

This section is designed as a quick guide to operating HYQUAL. It should allow the user to discover the capabilities of the package without needing to study the reference section of the manual.

3.1 Starting and logging on

HYQUAL is started from within the Windows environment by double clicking on the *HYQUAL* icon. It may also be started directly from DOS by first changing to the directory containing the HYQUAL files and then typing **HYQUAL** <Enter>. A title screen with a [Continue] button will be displayed. Click on the button to continue (or type C, or press <Enter>). HYQUAL will presents a window with a menu bar as shown in figure 3.1.

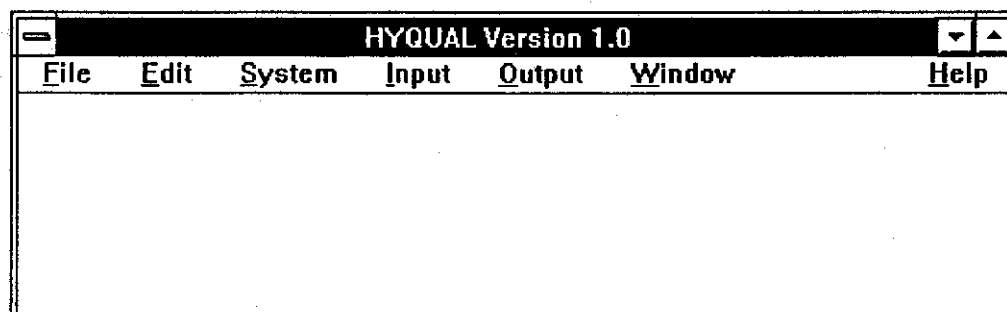


Figure 3.1

The first two menu items, [File] and [Edit], are not part of the HYQUAL database, but provide facilities to allow the user to create, access and edit external files and tabular output produced by HYQUAL.

HYQUAL uses a system of passwords to allow users different levels of access to its facilities. New passwords must be allocated by a system manager (see section 8). Most of the HYQUAL menu choices are "greyed-out" until the user's password is entered. To enter a password select [System] from the menu by clicking on it, or by pressing <Alt-S>, then select [Logon ...] from the sub-menu to display the dialog box shown in figure 3.2.

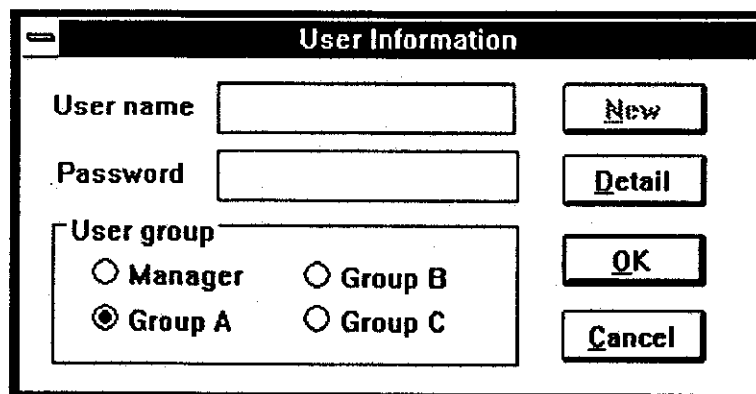


Figure 3.2

Enter a valid user name and password by clicking in the appropriate text box and then typing the required entry (note: the system manager must use the name and password set up through the System Manager program as described in section 8). User names and passwords

may contain up to nine characters. Next click on the appropriate user group category that has been assigned to the password (Manager, Group A, Group B or Group C). Finally, click on the [OK] button. Upon entry of a valid user name, password and user group category, all of the menu choices appropriate to the user group will become available for use. Manager and Group A categories have access to all of the HYQUAL facilities described below. Group B and C users will have restricted access to the facilities as described in section 8.

3.2 Setting up a sample point

Before any water quality information can be entered into HYQUAL, a structure must be set up. The following paragraphs explain how to do this, with tutorial examples.

- (i) **Define a region name.** Select the [System] menu and choose [Regions...] from the sub-menu to display the *Region Details* dialog box (figure 3.3). The region is used to describe the geographic area from which the water samples are taken. Type in a region code and then a region name. The code can be up to 9 characters and the name up to 29 characters long. HYQUAL uses the assigned codes to access the database, and the codes are indexed in alphabetical order.

Figure 3.3

The code references of any regions already defined are shown in the box marked "Region codes". When the region code and name have been entered, select the [Save] command button. The new code will appear in the Region codes list box and the text entry boxes will clear ready for the next entry. The procedure can be repeated until all of the required regions have been defined. Region names can be changed by double clicking on the region code in the region codes list box and editing the name in the name text box. Only the names of regions can be changed, not the code references. The only way to change an existing region code is to delete it and then re-enter it. Click on the [Exit] command button when all the required regions have been correctly entered. Similar methods are used when setting up the rest of the database structure.

Tutorial. Set up three regions as follows:

<i>Region Code</i>	<i>Region Name</i>
EAST	Eastern Region
NORTH	Northern Region

SOUTH Southern Region

Select the [Output] button on the *Region Details* dialog box to display the *Output Data Selection* dialog box (figure 3.4).

Output Data Selection

Code list

EAST
NORTH
SOUTH

First code

First

Last

Reset

First code

EAST

Last code

SOUTH

OK

Cancel

Figure 3.4

Click on the first region code (EAST) in the code list box and then on the [First] button. Click on the last region code (SOUTH) in the code list box and then on the [Last] button. Details of all the regions from the first to the last selected will appear in the output. To view the output click on the [OK] button. A text cursor will appear inside the output window (figure 3.5) and output can be edited as required. To test this try adding an extra header line. The window may be resized if required.

untitled.txt

HYQUAL V1.0

Instit

Regions Report

Code	Name
EAST	Eastern Region
NORTH	Northern Region
SOUTH	Southern Region

Institute of Hydrology

Fri Jul

Figure 3.5

The output may be saved to a disk file by selecting [File] from the main menu and [Save as...] from the sub menu. The disk drive, directory and filename to save the output to can be selected from the *Save As* window that is displayed (figure 3.6). An [Output] button is available on most of the dialog boxes used during the setting up of the database to allow a quick check of the input information. Close the output window (by clicking on the bar symbol at the top left) before continuing with the tutorial.

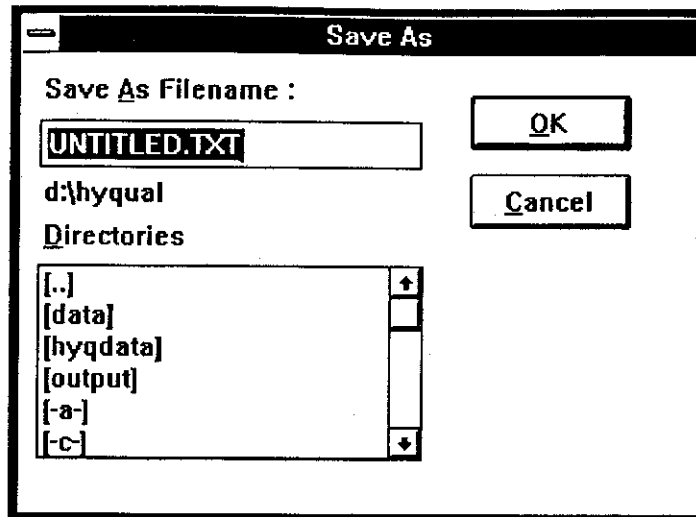


Figure 3.6

- (ii) **Define a cluster type.** Select the [System] menu and choose [Cluster types...] from the sub-menu to display the *Cluster Type Details* dialog box (figure 3.7). Cluster types provides a general description of a sample source, e.g. a lake, river or sewage works. Enter a short code (up to 9 characters) and a full name (up to 29 characters) for the cluster type into the code and name text boxes, then select the [Save] command button. The procedure can be repeated until all of the required cluster types have been defined. Cluster type codes can not be altered once they have been entered, but their descriptive names can be changed by double clicking on the code in the cluster codes list box and editing the name in the name text box. Click on the [Exit] command button when all the required cluster types have been correctly entered.

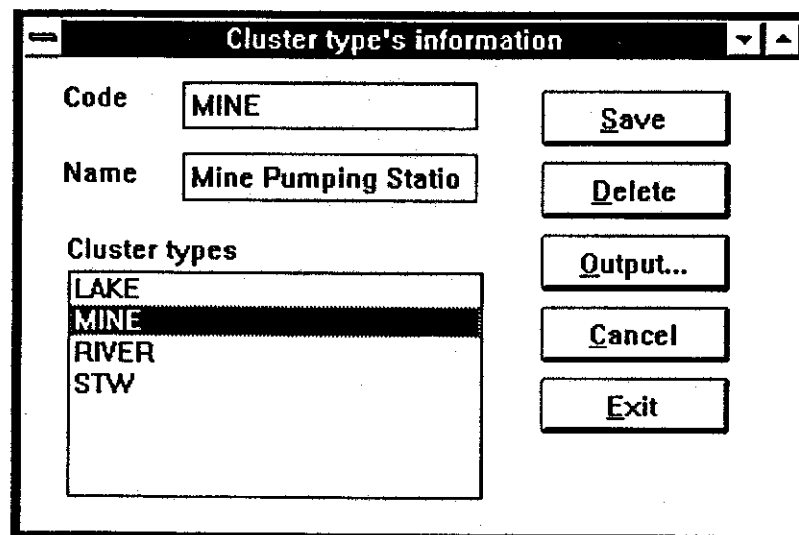


Figure 3.7

Tutorial. Set up four cluster types as follows:

Cluster Code	Cluster Name
RIVER	River
STW	Sewage Treatment Works

MINE Mine Pumping Station

LAKE Lake

Generate an output of cluster types in a similar way to that used to obtain the regions output.

- (iii) **Input a list of determinand types.** Determinands are the physical properties of the sample being measured, for example, oxygen content, alkalinity or temperature. Determinands may be added by choosing the [System] menu and then [Determinands...] from the sub-menu to display the *Determinand Details* dialog box (figure 3.8). The procedure for entering and editing determinand details is similar to that already described. Enter the determinand details, saving each one after entry. Each determinand is defined by a code (up to 9 characters), a full name (up to 29 characters) and a unit of measure. Standard upper and lower limits to sample values and safe levels can be included if required. These can be modified if necessary for individual sampling points. If limits are defined, any values outside of them will be flagged in all tabular and graphic output.

Determinand Details

Code Name

Determinand

BOD	↑
Cd	
Cu	
DO	
Fe	
NO3	
Pb	
pH	↓

Details

Measure unit

Upper limit

Lower limit

Safe level

Comment

Figure 3.8

Tutorial. Set up a short list of determinands using the table below. Note that the figures used are not based on any recognized standards and are included only for use as tutorial material.

Code	Determinand Name	Units	Upper limit	Lower limit	Safe level
BOD	Biological oxygen demand	ATU mg/l	30.0	0	3.0
pH	pH	-	10.0	3.0	8.0
Temp	Temperature	°C	25	0	22
TDS	Total dissolved solids	mg/l	1000.0	0	1000.0
TSS	Total suspended solids	mg/l	1000.0	0	25.0
DO	Dissolved oxygen	% sat.	100	0	80
NO3	Nitrate	mg/l N	20.0	0	5.0
PO4	Phosphate	mg/l P	5.0	0	0.04

Cd	Cadmium	mg/l	0.005	0	0.001
Cu	Copper	mg/l	0.005	0	0.02
Fe	Iron	mg/l	2.0	0	0.2
Pb	Lead	mg/l	0.01	0	0.05
Zn	Zinc	mg/l	0.2	0	0.5

Upper and lower case letters can be used for determinand codes. HYQUAL distinguishes between upper and lower case determinand codes so that FE and Fe would be seen as two different codes. The determinand list may be output in a similar way as for regions and cluster types but additional selections need to be made from the fields list box. Only selected fields will appear in the output.

- (iv) **Define sample types.** This menu choice allows the user to describe the kind of measurements being made at a particular sampling point, for example flow or rainfall. Select [system] from the main menu and [sample types...] from the sub-menu to open the *Sample Type Details* dialog box (figure 3.9). Enter a code and a name for the new sample type into the appropriate text boxes, and click once, in the determinand list box, on each of the determinands required for the sample. The selected determinands will become highlighted. To deselect a determinand click on it again. When all the required determinands in the Determinand list box are highlighted click on the

Figure 3.9

[Save] command button. Repeat the procedure for each sample type being defined or edited and then click on the [Exit] command button.

Tutorial. Set up three sample types with appropriate determinands:

<i>Code</i>	<i>Sampe type description</i>	<i>Determinands</i>
DISCHARGE	Discharge from sewage treatment works	BOD, pH, Temp
PUMP	Outflow from mine pumping station	Cd, Cu, Fe, Pb, Zn
QUALITY	River water quality	all defined determinands

Note that buttons are provided to allow instant selection and de-selection of all defined determinand. Use the [Select all] button to define the determinands for the

QUALITY sample type. The determinands appear in the determinand codes box in the order in which they were entered. It may be convenient to re-arrange their displayed

Figure 3.10

- order and a button is provided to allow this (figure 3.10). The defined sample types can be output in the same way as for the determinands.
- (v) **Define cluster details.** Details about each specific cluster can be entered after all the information about regions, cluster types, determinands and sample types have been defined and stored. Select the [System] menu and choose [Cluster...] to open the *Cluster Details* dialog box (figure 3.11).

Figure 3.11

This menu choice allows a specific cluster of sampling points to be described. This is done by choosing the region in which the cluster is located and the type of cluster. Select each of these from the list boxes labelled Region and Cluster type by first clicking on the arrow symbol to the right of the boxes. Clicking on the arrow symbols

will open scrolling list boxes that show the available regions and cluster types. Click on the required region and cluster type, then enter a code and a name for the new cluster (click inside the required box, or press the <Tab> key repeatedly until the flashing cursor appears). Select [save] to complete the operation. The new cluster code should be listed in the cluster codes box.

Tutorial. Define each of the following clusters. The regions and cluster types must be selected *before* entering the cluster code and cluster name.

Region	Cluster type	Code	Cluster name
EAST	RIVER	RIVER X	River X
EAST	RIVER	RIVER Y	River Y
EAST	STW	STW A	Sewage treatment works A
EAST	STW	STW B	Sewage treatment works B
EAST	STW	STW C	Sewage treatment works C
NORTH	RIVER	RIVER P	River P
NORTH	MINE	MINE I	Mine I
NORTH	MINE	MINE J	Mine J
SOUTH	LAKE	LAKE Q	Lake Q

This dialog box is also used to enter sample point details as described below. It can also be used to modify the determinand consent levels for a specific sampling point as described in paragraph (vii).

- (vi) **Define sample point details.** The *Cluster Details* dialog box (figure 3.11) described in paragraph (v) above is also used to define new sample points for a cluster (if the dialog box is not already displayed, select [System] from the main menu and [Cluster...] from the sub-menu). First select the required cluster by double clicking on its code name in the cluster codes list box and then click on [New SP]. Another dialog box, *Sampling point details*, will appear (figure 3.12).

Figure 3.12

This dialog box allows the user to record a description of a sampling point. The code and name must be entered and sample type selected but completion of the other information is optional (*Note: use of the "daily flow" check box is reserved for future releases of HYQUAL; it is inoperative in version 1.0*). After recording the information for the sampling point select the [save] command button. Repeat the process until all the required sample points have been set up then choose [exit] to close the dialog box.

To edit any previously defined sample point details first select the region and cluster type from the *Cluster Details* dialog box. Any clusters that have been defined for that region and cluster type will be shown in the cluster codes list box. Double clicking on any of these cluster codes will show the sample points for that cluster in the sample points list box. Double click on the required sample point to edit the details (or click once on the sample point and then on the [SP detail] button).

Tutorial. Use the cluster details form (figure 3.11) and the sampling point details form (figure 3.13) to enter the following sampling points. Additional information about elevation, catchment details and location may be added for each sample point if required.

Region	Cluster type	Cluster code	Sampling point	Sample type
EAST	RIVER	RIVER X	RX1	QUALITY
EAST	RIVER	RIVER X	RX3	QUALITY
EAST	RIVER	RIVER X	RX3	QUALITY
EAST	RIVER	RIVER Y	RY1	QUALITY
EAST	RIVER	RIVER Y	RY2	QUALITY
EAST	STW	STW A	SA1	DISCHARGE
EAST	STW	STW B	SB1	DISCHARGE
EAST	STW	STW B	SB2	DISCHARGE
EAST	STW	STW B	SB3	DISCHARGE
EAST	STW	STW C	SC1	DISCHARGE
EAST	STW	STW C	SC2	DISCHARGE
NORTH	RIVER	RIVER P	RP1	DISCHARGE
NORTH	MINE	MINE I	MI1	PUMP
NORTH	MINE	MINE I	MI2	PUMP
NORTH	MINE	MINE I	MI3	PUMP
NORTH	MINE	MINE J	MJ1	PUMP
SOUTH	LAKE	LAKE Q	LQ1	QUALITY

- (vii) The *Cluster Details* dialog box (figure 3.11, page 17) can also be used to modify the determinand consent levels for a specific sampling point. To try this, highlight the cluster code for River X and the sampling point RX1, then click on the [SP determinands] button to display the dialog box shown in figure 3.13

A list of the determinands that have been defined for the sampling point is displayed. Clicking on any of the determinands will display the upper and lower limits and the safe level as originally defined for the sample type. These may be edited and the modified levels will be applied to this sample point only; the standard levels as defined for the original sample type will be unaffected.

Determinand consent levels

Sample point: RX1

Determinand details

Code: BOD Name: Biological oxygen demand

Determinand	Details
BOD	Upper limit: 20
pH	Lower limit: 0
Temp	Safe level: 3

Update **Exit**

Figure 3.13

3.3 Samplers, analysts and laboratories

The stages in setting up a water quality database described above in section 3.2 are all necessary before any sample data can be entered. There are other, optional, items of sample information that may need to be added before sample data is entered. These include the names of the sampling staff and the analysts and their laboratories. The [system] menu offers three choices, [Samplers...], [Analysts...] and [Laboratories...], that lead to dialog boxes for entering the relevant information. These three dialog boxes are similar and the one for entering analysts details is shown in figure 3.14.

Analyst Details

Code: CW Name: White

Initials: C Telephone:

Address:

Laboratory: CHEMCO

Code list: AM, CW

Comments:

Save **Delete** **Output...** **Cancel** **Exit**

Figure 3.14

When sample details are being entered it is possible to tag them with the codes for the samplers and the analysts. This information can then be included in reports if required. In the analyst details dialog box (figure 3.14), it is possible to attach a code representing the

analyst's laboratory. If this is needed it will be necessary first to enter the laboratory details via the [Laboratories...] choice on the [System] menu.

3.4 General sample information

When a sample point has been defined and saved, information about samples for that point can be entered. Choose [Input] from the main menu, then [New data...] from the sub-menu to open the *Select a sampling point* dialog box (figure 3.15).

The dialog box titled "Select a Sampling Point" contains the following elements:

- Region:** A list box showing "EAST" with a downward arrow.
- Cluster type:** A list box showing "RIVER" with a downward arrow.
- Cluster:** A list box showing "RIVER X" with a downward arrow.
- Sampling point:** A list box showing "RX1", "RX2", and "RX3" with a downward arrow.
- Buttons:** Three buttons are located on the right side: "Sample", "Daily flow", and "Exit".

Figure 3.15

Use the appropriate list boxes to select a region, a cluster type, a cluster and a sampling point in that order, then click on the [Sample] command button.

Tutorial. Select the EAST region, the RIVER cluster type, the RIVER X cluster and the RX1 sampling point.

A new dialog box, *General sample information* (figure 3.16), will be made available for entry of a general description of a sample. The cluster and sampling point codes are shown at the top and below these are text boxes for entry of a sample code, a sampling date and time and an analysis date and time. The sampling and analysis dates default to the last ones entered and the time defaults to that set via the [Options...] choice on the [System] menu (see section 3.4). Once these items have been entered and saved they may not be changed through the editing procedure. Any attempt to do so will generate an error message.

Optional items of information for the sample are sampler and analyst codes (these are selected from drop-down lists and must already have been defined as described in section 3.3), purpose of the sample, weather, colour, clarity, taste, smell, suspended solids and comments. All of these optional items may be edited subsequently if necessary.

Tutorial. Set up a sample using the general information shown below (the value for BOD in this sample has been set to exceed the safe level and a warning will be given). Users should create their own optional items of general information.

When entering dates and times observe the different effects of moving between boxes using the <Enter> key, the <Tab> key and the mouse. Try high-lighting part of a field by holding down the <Shift> key whilst moving the cursor, then typing in new data. Learning the editing short-cuts will speed up data entry.

Sample code	Sampling date	Sampling time	Analysis date	Analysis time
R0001	21/05/93	10:00:00	23/05/93	14:00:00

General Sample Information			
Cluster: RIVER X		Sampling point: RX1	
Sample code	<input type="text" value="R0001"/>	Sampling date	<input type="text" value="21/05/93"/>
		Sampling time	<input type="text" value="10:00:00"/>
		Analysis date	<input type="text" value="23/05/93"/>
		Analysis time	<input type="text" value="14:00:00"/>
Sampler code	<input type="text" value="JS"/>	Analyst code	<input type="text" value="CW"/>
Purpose	<input type="text"/>	Weather	<input type="text"/>
Sample attributes			
Colour	<input type="text"/>	Clarity	<input type="text"/>
Taste	<input type="text"/>	Smell	<input type="text"/>
Suspended solids	<input type="text"/>		
Comments			
<input type="button" value="Determinands..."/> <input type="button" value="Save"/> <input type="button" value="Cancel"/>			

Figure 3.16

The determinands for the sample are entered by clicking on the [Determinands] button to display a dialog box titled *Determinands detail for the sample* (figure 3.17). The determinands defined for the sample type will be displayed but others may be added if required.

Tutorial. Enter the determinand details given below. Input of each value must be completed with the <Enter> key; failure to complete inputs with the <Entry> key will result in the loss of the determinand data for that sample, necessitating re-entry via the edit procedure. Please note the 'S' after the BOD value of 3.2. This is a data entry flag signifying a suspicious value and its use will cause flags to appear in tabular and graphical output. Data entry flags can be set via the [Options...] sub-menu (see section 3.4).

BOD	pH	Temp
3.2S	7.2	12.0

After entering the determinands click on the [save] button for that dialog box and again on the [save] button for the *General sample information* dialog box. Repeat the procedure for the samples in the table below.

Sample code	Sampling date	Sampling time	Analysis date	Analysis time	BOD	pH	Temp
R0002	22/05/93	08:15:00	24/05/93	13:20:00	2.9	8.0	13.5
R0003	23/05/93	11:00:00	25/05/93	09:45:00	2.2	6.2	14.9

R0004	24/05/93	14:30:00	26/05/93	15:00:00	1.7	7.0	15.6
R0005	25/05/93	09:15:00	27/05/93	11:30:00	1.2	5.5	16.2

Determinands Detail for the Sample			
Sampling point:	RX1		Sample code R0001
Data validation			
<input checked="" type="checkbox"/> Check vs maximum	<input checked="" type="checkbox"/> Check vs minimum	<input checked="" type="checkbox"/> Check vs safe-level	
Temp	<input type="text" value="18"/>	°C	
BOD	2.5	N	RTU mg/l
pH	7.2	N	-
Temp	Missing	N	°C
<div> <input type="button" value="Add determinands..."/> <input type="button" value="Save"/> <input type="button" value="Cancel"/> </div>			

Figure 3.17

Existing sample details can be edited using similar dialog boxes but accessing them through the [Input] choice on the main menu and the [Edit data...] choice on the sub-menu.

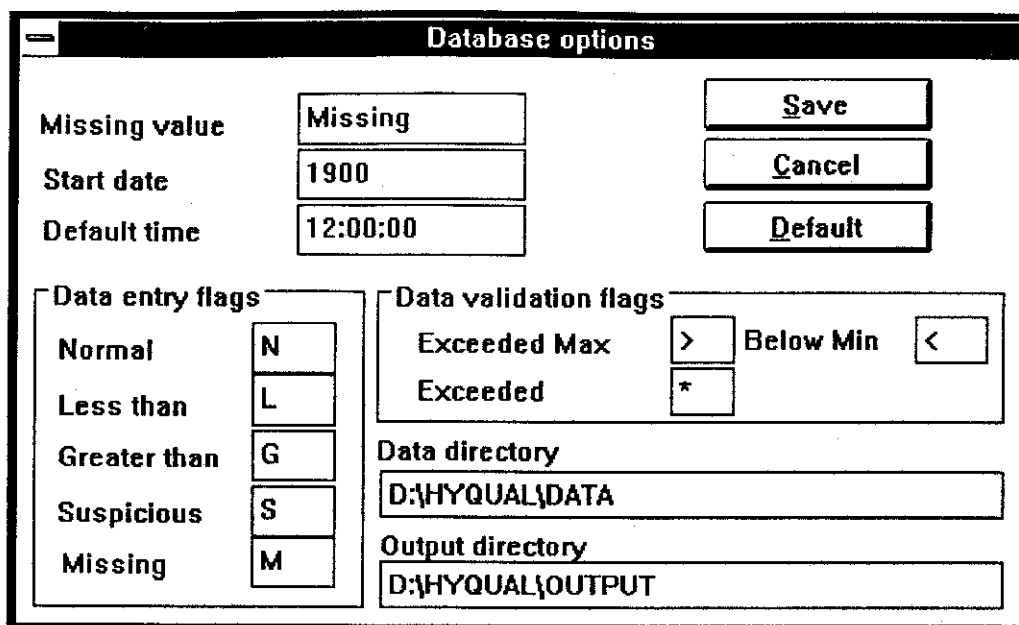
3.4 The options menu

Selection [Options...] from the [System] menu causes the *Database options* dialog box to be displayed (figure 3.18).

This allows modification of the appearance of some of the default values and flags used by the database. If there are missing values for sample determinands they will be indicated by the word 'Missing' unless this is changed through the options dialog box. Similarly, the start year and default times will be assumed unless altered here. Data entry flags appear against determinands during input and the default values may be changed if required. Data validation flags for maximum, minimum and safe levels appear in tabular output against values that fall outside the defined ranges, and these flags may also be changed. Finally the data and output directories can be changed. New directories will be created by HYQUAL if necessary.

3.5 Daily flow

If daily flow is being measured at a sample point, the data may be stored in the HYQUAL database. From the main menu select [Input] then [New data...] from the sub-menu and the [Daily flow] button from the *Select a sampling point* dialog box (figure 3.15). A dialog box called *Daily flow edit* will be displayed (figure 3.19).



Database options

Missing value:

Start date:

Default time:

Data entry flags

Normal ☐

Less than ☐

Greater than ☐

Suspicious ☐

Missing ☐

Data validation flags

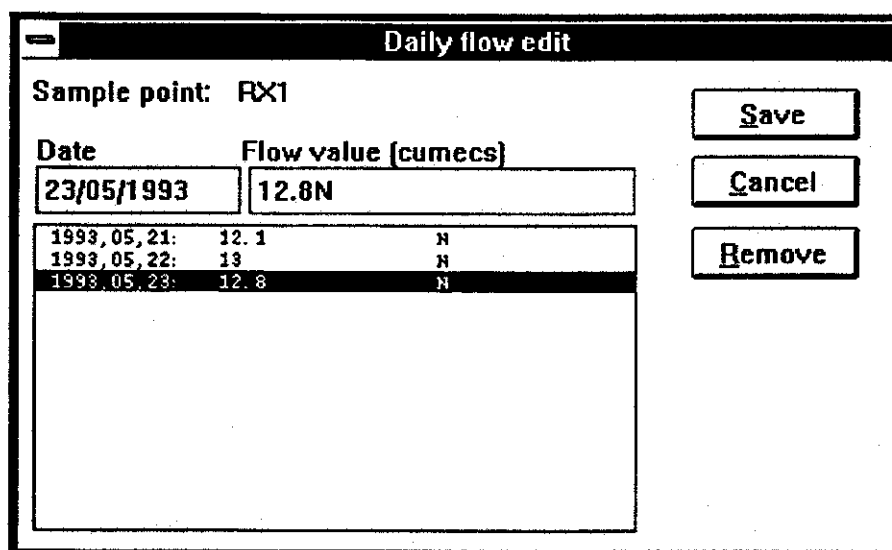
Exceeded Max > Below Min <

Exceeded

Data directory

Output directory

Figure 3.18



Daily flow edit

Sample point: RX1

Date: Flow value (cumecs):

1993, 05, 21:	12.1	N
1993, 05, 22:	13	N
1993, 05, 23:	12.8	N

Figure 3.19

Date and flow values can be entered. Each value must be terminated by using the <Enter> key. The data values will not be stored unless the <Enter> key is used. As each pair of values is entered they will appear in the list box. Incorrectly entered values can be removed by clicking on the required line in the list box and then on the [Remove] button.

3.5 Tabular output

Tabular output is obtained through the [Output] option on the main HYQUAL menu. The first four items on the sub-menu are [Cluster], [Sample point...], [Sample...] and [Daily flow...]. All are able to provide tabular output. Each of these leads to dialog boxes that can be used to regulate the amount of information that will appear in the reports. The first of these is shown in figure 3.20. A single cluster or a range of clusters can be selected. Click on the cluster code that you want the report to commence with, and then on

the [First] button. Next click on the last cluster code you require and then on the [Last] button. The first and last cluster, and all others in between, will appear in the report. If information on only one cluster is required, select it as both the first and the last required code. A short-cut for selecting the first and last cluster codes is to double click on each.

Figure 3.20

Next select the fields that are needed for the report by clicking on each required one in the order that they are to appear in. Two command buttons called [Region] and [Cl Types] are available to restrict output to certain regions or cluster types if necessary. These buttons lead to dialog boxes that can be used to select a region or cluster type, or a range of each. When all of the required information has been selected, click on the [OK] button to display the tabular report on the screen. Figure 3.21 shows an example. As with all other tabular reports in HYQUAL, this one may be edited, printed or saved to disk file.

HYQUAL V1.0

Institute of Hydrology

Cluster Report			
Code	Cl-Type	Region	Name
LAKE Q	LAKE	SOUTH	Lake Q
MINE I	MINE	NORTH	Mine I
MINE J	MINE	NORTH	Mine J
RIVER X	RIVER	EAST	River X
RIVER Y	RIVER	EAST	River Y

Institute of Hydrology
Fri Jul 16 18:42:49 1993

Figure 3.21

The tabular reports for sample points, samples and daily flows are produced using similar methods to that for the clusters. There is one other tabular report obtainable from the [Database structure...] option on the [Output] menu. This produces a simple tree showing the

relationships between the regions, cluster types, clusters and sample points. Part of this tree for the sample database set up during the tutorial is shown in figure 3.22

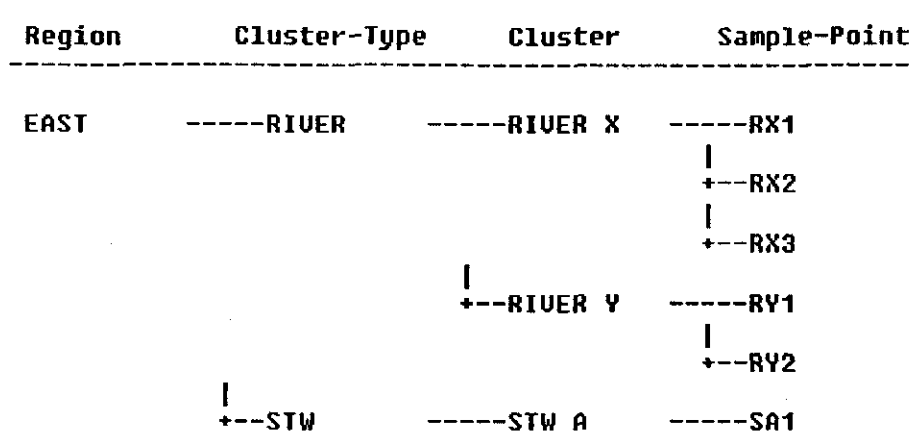


Figure 3.22

3.6 Graphical output

All graphical output is produced through the [Graphics] option on the [Output] menu. Four choices are offered; [Time series...], [Multi-sites...], [Scatter...] and [Bar graph...]. Figure 3.23 shows an example of output for a time series graph.

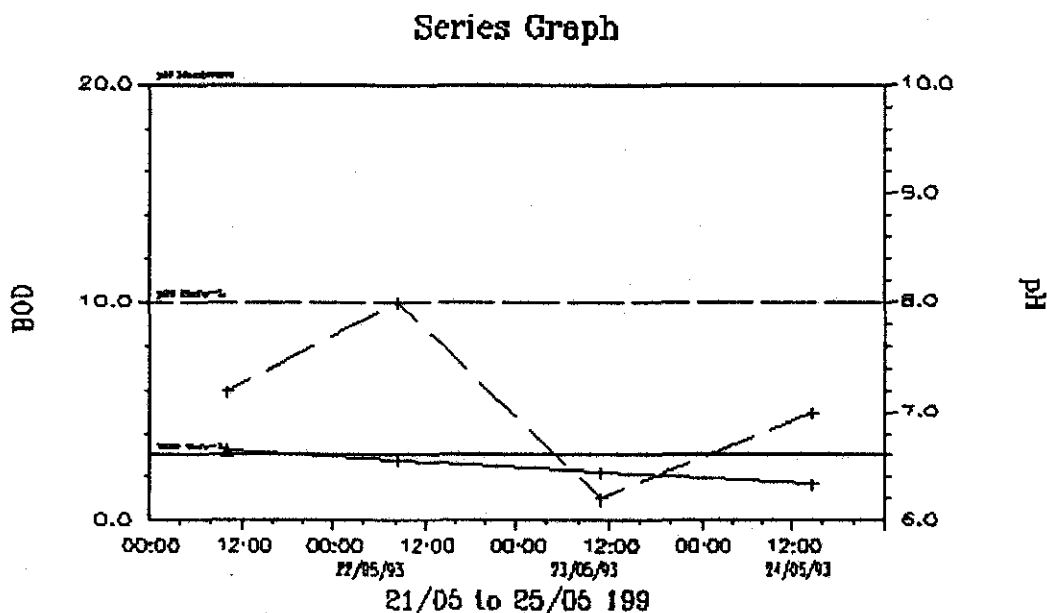


Figure 3.23

Tutorial. Select [Graphics] from the [Output] option on the main menu and [Time series] from the sub-menu. Make the following choices from the appropriate list boxes (figure 3.24):

List box	Choice
Region	EAST
Cluster type	RIVER
Cluster	RIVER X
Sample point	RX1

Graphics Information			
Region EAST	Cluster type RIVER	Cancel	Process
Cluster RIVER X		Graph define	
Sample point RX1 RX2 RX3	Determinands BOD Cd Cu DO	Reset data	
	Y1-data Y2-data Legend	Date and Time Start date: 21/05/93 Start time: 10:00:00 End date: 25/05/93 End time: 09:15:00	

Figure 3.24

Select BOD from the determinands list box and click on the [Y1 data] button, then select pH from the determinands list box and click on the [Y2 data] button. The Y1 scale will be shown at the left of the graph and the Y2 at the right. This helps with the display of determinands having varying scales, for example, pH which may have a value in the range 3.5 to 8.5 has a scale going up to 10 while total dissolved solids (TDS) may range between, say, 500 and 1500. Enter 21/05/93 and 10:00:00 as the start date and time and 25/05/93 and 09:15:00 as the end date and time and finally click on the [Process] button. A graph will be displayed, similar to the one shown in figure 3.23

The appearance of the graph can be altered by setting a range of parameters accessible through the [Graph define] button. This displays the dialog box shown in figure 3.25

Graph Definition																					
Graph type	Time Series																				
Titles Graph title: Series Graph X-title: 21/05 to 25/05 199 Y1-title: BOD Y2-title: pH																					
Options <input checked="" type="checkbox"/> Colours <input checked="" type="checkbox"/> Safe-L <input checked="" type="checkbox"/> Symbol <input checked="" type="checkbox"/> Border <input checked="" type="checkbox"/> Max <input checked="" type="checkbox"/> Lines <input checked="" type="checkbox"/> Grid <input type="checkbox"/> Min <input checked="" type="checkbox"/> Miss value <input checked="" type="checkbox"/> Auto scale <input type="checkbox"/> Y2 bar <input checked="" type="checkbox"/> Y2-upward																					
Axes information <table border="1"> <tr> <td>X-inc</td> <td></td> <td>X-min</td> <td></td> <td>X-max</td> <td></td> </tr> <tr> <td>Y1-inc</td> <td></td> <td>Y1-min</td> <td></td> <td>Y1-max</td> <td></td> </tr> <tr> <td>Y2-inc</td> <td></td> <td>Y2-min</td> <td></td> <td>Y2-max</td> <td></td> </tr> </table>				X-inc		X-min		X-max		Y1-inc		Y1-min		Y1-max		Y2-inc		Y2-min		Y2-max	
X-inc		X-min		X-max																	
Y1-inc		Y1-min		Y1-max																	
Y2-inc		Y2-min		Y2-max																	
Save definition Load definition OK Cancel																					

Figure 3.25

The titles (Graph, X, Y1 and Y2) that are displayed in the Titles area will default to those previously used. They can be edited as required.

Similar techniques are used to display the other graphical output formats. Graphs may be printed or saved to disk file via the [File] option on the main menu. Experienced users of Windows who have access to graphical manipulation utilities and a word processor running under Windows will realise that the HYQUAL graphs could be cut and pasted directly into reports if required.

4. HYQUAL DATABASE STRUCTURE AND DATA ENTRY

4.1 Regions

All sample data stored in HYQUAL are grouped into regions. Each region is identified by a region code name having up to 9 characters. A full name with up to 29 characters can also be added. Regions can be any convenient geographic area.

Regions are set up by choosing [System] from the main menu and then [Regions...] from the sub-menu. Figure 3.3 (page 12) shows an example of the dialog box that appears. When the dialog box is first displayed, a flashing cursor will appear in the text box labelled Code. To add a new region type an appropriate code name into this text box using up to 9 characters. A full name for the region can be added if required. Press the <Tab> key on the keyboard or click inside the Name text box and type in a region name, using up to 29 characters. Clicking on the [save] button (or pressing the <Tab> key repeatedly until it is highlighted, then pressing the <Enter> key) will store the new region details in HYQUAL. The new region code will be displayed in the list box labelled Region codes.

A region can only be deleted from the database when no subsidiary information for that region has been stored in the database. To delete a region, either type its code name in the Code text box or double click on the code name in the the Region Codes list box, then select the [delete] command button.

A list of the regions that have been stored on the system can be produced by selecting the [Output] command button to display the dialog box called *Output data selection* (figure 3.4, page 13).

The available region codes will be displayed in alphabetical order in the Code list box. The user may choose to output a range of regions by clicking on the first region code required followed by the [first] command button, then on the last region code required followed by the [Last] command button. Selecting the [OK] button will cause the report to be output to the screen. The report is displayed as a table listing the selected region codes and their full names in alphabetical order, as shown by the example in figure 3.5 (page 13).

The report will be displayed in a window which, until the report is given a name, will be called *untitled.txt*. The scroll bars at the right and bottom sides of the window can be used to view parts of the report that are not visible in the window or the window can be resized. It can, if required, remain in the background on the desktop while the user continues with other HYQUAL operations.

The report can be printed out to a hardcopy device attached to the computer by choosing the [File] command from the main menu and then the [Print] command from the drop-down sub-menu. The report can be edited in the window if required. All or any part of it can also be copied to other reports or stored as a file on disk. The methods are described in section 5.

To close the report window select the [Close] option via the control-menu box at the top left corner of the window (the small box with the horizontal bar) or pressing <Ctrl-F4>) or by selecting [Window] from the main menu and then [Close All] from the sub-menu.

4.2 Clusters and cluster types

In the same way that regions are used by HYQUAL to associate sampling points with convenient geographic areas, "clusters" are used to associate sampling points with particular geographic features within the regions. A cluster could, for example, describe a group of sampling points on a river, or at a sewage treatment works. This division into regions and

clusters is intended to help the user find any sampling point in the database quickly and efficiently. Of course, all sample points may be defined as being in the same region and cluster if that is what is required.

As each cluster is defined and given a code name and a full name, it is useful to label them with generic descriptions of the type of geographic feature being defined. A cluster might, for example, be a lake, a river, or a sewage treatment works. These general descriptions are called cluster types in HYQUAL. Cluster types must be defined before any clusters can be set up.

Defining cluster types and producing tables of them are both carried out in the same way as for Regions described above and in section 5. The dialog boxes and procedures are very similar. Select [system] from the main menu, then [Cluster types...] from the sub-menu and proceed as for Regions.

After cluster types have been defined the clusters themselves may be entered. Select [system] from the main menu and [Clusters...] from the drop-down sub-menu, then enter the required clusters. The methods are similar to those used for entering regions and cluster types.

A report in the form of a table showing the list of available clusters is produced by selecting [Output] from the main menu and [Cluster] from the sub-menu. The dialog box used to produce the table, *Data selection*, is shown in figure 3.20 (page 25).

Selecting [Default] followed by [OK] will produce a table showing the code names of all the clusters in the database with their types, regions and full names. The output can be refined to meet the user's requirements by choosing ranges for regions and cluster types, using the [Region] and [Cl Type] command buttons, and selecting which fields will appear on the report by using the Fields list box to highlight each in turn, in the order required, and clicking on the [Select] button. The selected fields will appear in the Fields selected list box. Incorrect selections can be cancelled by highlighting the field in the Fields selected box and clicking on the [Deselect] button. An example of output is shown in figure 3.21 on page 25. The table can be edited as described in section 5.

4.3 Determinands

Determinands represent various aspects of water quality for which measurements and records are required. Examples of determinands are temperature, acidity and nitrate content. The range and type of determinands being measured will vary according to the purpose for which the water samples are needed.

All determinands that are going to be used must be defined using the [Determinands...] choice in the [system] menu. This will display the dialog box shown in figure 3.8 on page 15. The determinand code can be up to nine characters long and the full name up to 29 characters. The unit of measure, upper and lower limits and safe level can also contain up to nine characters. These parameters can be displayed in output reports and can also be used to prompt warnings of out-of-range data during entry.

A report of defined determinands can be produced by clicking on the [Output] button.

4.4 Sample types

Sample types provide a quick method of assigning standard sets of determinands to sampling points. A sample type is defined by choosing [system] from the main menu, followed by [Sample types] from the sub-menu. The dialog box, *Sample Type Details*, is displayed as shown in figure 3.9 on page 16.

The code name to be used for the sample type must be typed into the Type code text box, and the determinands to be assigned to this sample type are chosen by clicking on the selections in the Determinand codes box. Each selected determinand will become highlighted and, when the selection is complete, clicking on the [Save] button will store the sample type details in the database.

The [Output] option in the dialog box provides a facility for producing a table of available sample types.

The user must select the first and last sample type code from the code list box. Additionally, the fields that are required on the table must be chosen from the Fields list box. The [Default] button will select all the fields listed, i.e. the code name, the number of determinands, and the list of determinands. This resulting table can be edited, saved or printed to hardcopy device as described in section 5.

4.5 Sampling points

All water quality data held on the system is related to a sampling point identified by a code. Each sample point within a region must have a unique code, but duplicate codes can be used in different regions. The sampling points might be at a water quality monitoring station on, for example, a river, lake or estuary. There may be several sampling points at a single water quality monitoring station, which is why the concept of sampling point clusters is used.

Clusters and sampling points are both defined via the dialog box, *Cluster details*, shown in figure 3.11 on page 17. To display this dialog box select [System] from the main menu, then [Cluster] from the sub-menu.

Choose a region first and then a cluster type from the appropriate list boxes (lists of existing codes are revealed by clicking on the arrow symbol). A list of previously defined cluster codes for the selected region and cluster type will appear in the Cluster code list box. New clusters can be added by entering a code and full name in the appropriate text boxes and clicking on the [Save] button. The new code will appear in the list box.

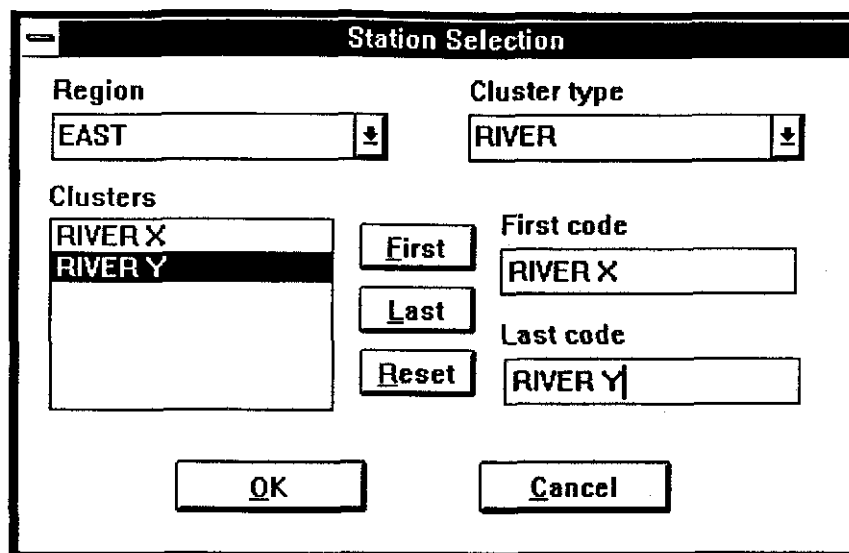
To define sampling point details for a specific cluster, highlight the cluster code by double clicking on it then click on the [New SP] button. Sampling points that have already been defined can be edited by clicking on the [SP detail] button. Sampling point details are defined using the dialog box, *Sampling Point Details*, shown in figure 3.13 on page 19.

Apart from the sampling point code, all of the information that can be entered on the dialog box is optional. The Sample type list box can be used to assign a set of default determinands to the sample point. When all the required information has been entered use the [Save] button to store the sample point details in HYQUAL.

A printout of the sample points can be obtained by choosing [Output] from the main menu and [Sample point...] from the sub-menu to display the dialog box, *Station Selection* (figure 4.1). A list of all the sample points for any region can be obtained by choosing the region and cluster type from the appropriate list boxes, selecting the first and last cluster required from clusters list box, then clicking on the [OK] button.

On choosing [OK] a further dialog box, *Data Selection*, appears (figure 4.2) requesting information about the set of sample codes required, and the fields to be printed on the table. The user can either choose which fields will be printed and in what order, or else select the [Default] button to print all the fields in the order displayed in the fields list box.

The report can be edited, cut to the Windows clipboard, saved to a file on disk or printed to a hardcopy device as described in section 5.



Station Selection

Region: EAST Cluster type: RIVER

Clusters: RIVER X, RIVER Y

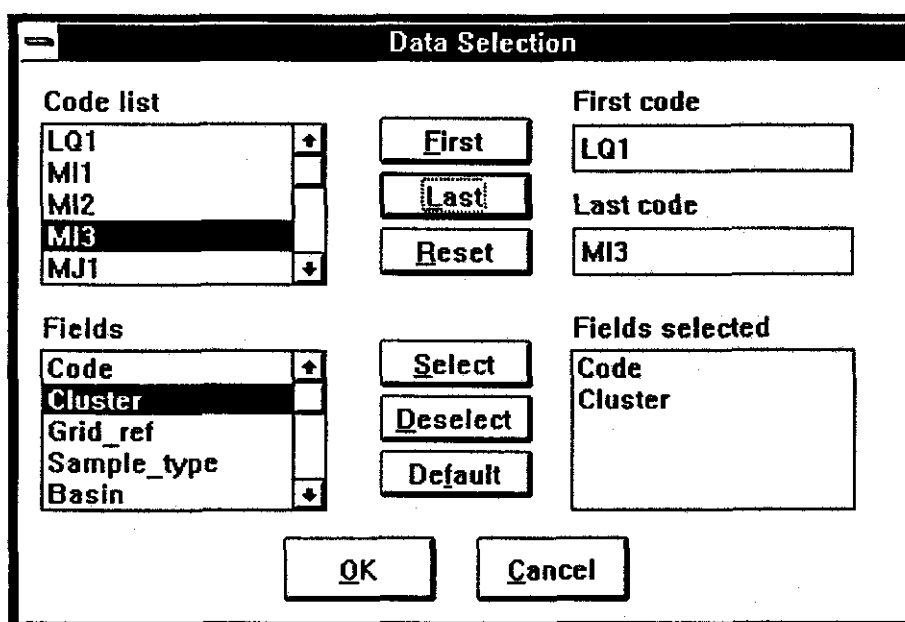
First: First code: RIVER X

Last: Last code: RIVER Y

Reset

OK Cancel

Figure 4.1



Data Selection

Code list: LQ1, MI1, MI2, MI3, MJ1

First: First code: LQ1

Last: Last code: MI3

Reset

Fields: Code, Cluster, Grid_ref, Sample_type, Basin

Select: Fields selected: Code, Cluster

Deselect

Default

OK Cancel

Figure 4.2

4.6 Samples

The purpose of the system is to hold water quality information relating to water samples that have been taken from sampling points. In HYQUAL the sampling points are grouped into clusters and the clusters into regions. Each sample taken at a sampling point must be given a sample code that is unique for that sampling point.

Sample information is entered into the system by choosing [Input] from the main menu and [New data...] from the sub-menu. Using the dialog box, *Select a Sampling Point*, (figure 3.15, page 21) select the required region, cluster type, cluster and sampling point, then click on the [sample] button to open the *General Sample Information* dialog box (figure 3.16, page 22).

The *General Sample Information* dialog box provides a form for entering the general information about the sample. A sample code, sampling date and time and analysis date and time must be entered, but addition of the rest of the information is optional.

Having entered the general information it is then possible to enter values for the list of determinands by selecting the [*determinands...*] button. A further dialog box, *Determinands Details for the Sample* (figure 3.17, page 23), is then made available that allows the user to enter values for the list of determinands assigned to that sampling point

The list of determinands in the dialog box shows the ones that were set up when the sample type was defined. Each determinand value may be entered in sequence by typing the value in the text box and pressing the <Enter> key. Alternatively, use the mouse to select particular determinands first and then enter the values. (Note: it is important to press the <Enter> key after typing in the value. Just clicking on the [*Save*] button will not store new values entered into the text box unless the <Enter> key has been pressed.)

Initially, the determinands are all given a default value of "missing". The value of any determinand may be accompanied by a marker, or "flag", as follows:

N = Normal
L = Less than
G = Greater than
S = Suspicious
M = Missing

The flag should be entered immediately after the determinand value, thus 1.3L would be recorded as a value that is below the acceptable lower level. The default flag is N for Normal, and any number followed by M is assumed to be missing information. Flags are indicated by symbols on tabular and graphic outputs. Flags may be changed through the [*Options...*] choice on the [*System*] menu

Other determinand values can be introduced to the table by selecting the [*Add determinands*] button. The list of defined determinands not already included in the current sample type is then made available for the user to choose additional ones. If these additional determinands are to be recorded on a regular basis it is best to edit the sample type for this sample point to include the new determinands.

Having entered all the determinand information the [*Save*] button should be selected on each of the dialog boxes (*Determinands Detail for the Sample* and *General Sample Information*). The changes are not stored, and will not therefore be available for editing, until both [*Save*] buttons have been selected.

Sample data can be edited by choosing [*Input*] from the main menu and [*Edit data...*] from the sub-menu. The procedure for defining the sample point is identical to that for entering new data, and the dialog boxes are similar. The only difference is that the *General Sample Information* dialog box offers a sample codes list box from which to select a sample to edit.

A list of samples, together with general information or determinand values, can be produced for any sample point. Select [*Output*] from the main menu and [*Sample*] from the sub-menu. A valid region, cluster type, cluster and sample point must be chosen in the dialog box, *Select a Sampling Point* (figure 4.3).

The [*General*] button reveals a *Data Selection* dialog box (figure 4.4) for specifying the output required. Clicking on [*Full Information*] and then on [*OK*] will provide a complete list of all the samples for the chosen sample point, together with general information.

Select a Sampling Point

Region: EAST Cluster type: RIVER

Cluster: RIVER X, RIVER X, RIVER Y

Sampling point: RX1, RX2, RX3

Buttons: General, Details, Exit

Figure 4.3

Data Selection

Samples: R0001, R0002, R0003, R0004, R0005

Buttons: First, Last, Reset

First code: [] Last code: []

Buttons: OK, Cancel

Checkboxes: Full information, Restrict, Format output

Checkboxes: Sample date, Analysis date, Weather, Sample time, Analysis time, Attributes, Sampler code, Analyst code, Purp/Comments

Figure 4.4

If the full default information is not required, a range of sample codes may be specified by using the [First] and [Last] buttons in the *Data Selection* dialog box. The output can be restricted to a range of dates and to a single sampler or analyst by clicking on the Restrict button and completing the *Sample Restriction* dialog box. There are check boxes on this dialog box that can be used to activate and de-activate the restrictions.

If the [Details] button is chosen, rather than [General], another dialog box, *Data selection*, (figure 4.5) allows a choice of determinands to be listed with each sample. If [default] is selected from this dialog box, then [OK], a table is displayed, giving information about the date and time of sampling, together with all determinand values.

If the default list is not required, the user can has control over:

The selection of samples to be reported through the [First] and [Last] buttons.

The determinands to be included using [Add], [Remove] and [Default] buttons.

A choice of range of dates, a sampler and an analyst selection through [Restrict].

The format of the output through [Sort Code] check box, which produces a table sorted by code name rather than date of the sample, which is the default.

The omission of times from the table through [No time field] check box.

The omission of flags from the table through the [No data entry flag] and [No data validation flag] check boxes.

The omission of code names from the table through [No Code field] check box.

The omission of statistics through the [No statistics] check box.

The **Data Selection** dialog box contains the following elements:

- Samples:** A list box with items R0001, R0002, R0003 (selected), R0004, and R0005.
- First code:** A text box containing R0001.
- Last code:** A text box containing R0003.
- Buttons:** First, Last, Reset, OK, Cancel, and Restrict.
- Checkboxes:**
 - ☐ Sort code
 - ☐ No time field
 - ☐ No data entry flag
 - ☐ No data validation flag
 - ☐ No Code field
 - ☒ No statistics
- Determinands list:** A list box with items BOD, Cd, Cu, DO, Fe, and N03 (selected).
- Determinands selected:** A list box with items BOD, DO, and N03.
- Buttons:** Add, Remove, and Default.

Figure 4.5

The **Sample Restriction** dialog box contains the following elements:

- Cluster:** A text box.
- Sample point:** A text box.
- Restrictions:**
 - Start date:** A text box.
 - End date:** A text box.
 - Sampler:** A dropdown menu showing JS.
 - Analyst:** A dropdown menu showing AM.
- Restriction options:**
 - ☐ Restrict by date
 - ☐ Restrict by sampler
 - ☐ Restrict by analyst
- Buttons:** OK and Cancel.

Figure 4.6

The [Restrict] button can be used to display the *Sample Restriction* dialog box (figure 4.6), which is used to limit the report to a range of dates and a single sampler or analyst. The selected restrictions can be activated and de-activated using the check boxes provided.

All of these options together provide the user with full control over the information produced in the reports.

5. TABULAR REPORTS

As an aid to managing the information stored in HYQUAL, all of the data can be listed as reports in tabular format. The method is similar in each case and this section gives an example of how to produce, edit and print a table of the regions that have been defined by the user.

5.1 Producing tables

To produce a table for regions select [System] then select [Regions...] from the sub-menu to display the *Region Details* dialog box (figure 3.3 on page 12). Select the [Output] command button to display the dialog box called *Output data selection* (figure 3.4 page 13).

The available region codes will be displayed in alphabetical order in the code list box. The user may choose to output a range of regions by clicking on the first region code required and the [First] command button, then the last region code and the [Last] command button (a short-cut is to double click on the required first and last region codes. Having done this, selecting the [OK] button will cause the report to be output to the screen. The report is displayed as a table listing the selected region codes and their full names in alphabetical order, as shown by the example in figure 3.5 on page 13.

The report will be displayed in a window which, until the report is given a name, will be called *untitled.txt*. The scroll bars at the right and bottom sides of the window can be used to view parts of the report that are not visible in the window or the window can be resized. It can, if required, remain in the background on the desktop while the user continues with other HYQUAL operations.

5.2 Saving a report to disk

It is also possible to store the report as a disk file if it needs to be recalled for future use. Select the [File] command on the main menu then the [Save as...] command from the sub-menu. A dialog box called *Save As* is displayed, as in figure 3.6 on page 14. Enter a file name in the [Save As Filename:] text box and select the [OK] button to save the file in the current disk directory, which is shown beneath the file name text box (d:\hyqual in the example shown). The file can be saved to a different disk drive and/or directory by selecting from the Directories list box. Disk drives are represented by letters with a dash on each side. Directory names and disk drive letters are both shown within square brackets, for example [-c-]. The double period, [..], in figure 3.6 is used to indicate a lower level in the directory structure. Clicking on it causes the directory list to change.

5.3 Editing reports in a window

Reports can be edited in the screen window. When the window is first opened there will be a flashing cursor in the top left corner. This can be relocated to the required editing position using the mouse or the arrow keys on the keyboard. All or part of the report can be cut to the Windows clipboard (see the Windows user manuals for details) and pasted from the clipboard to a different part of the same report, or to a another report window. Additional editing facilities, including the capability to search for a word or phrase, are available through the [Edit] option of the main menu.

5.4 Printing reports

The report can be printed out to a hardcopy device attached to the computer by choosing the [File] command from the main menu and then the [Print] command from the drop-down sub-menu.

After all editing is complete the report window can be closed by selecting the [Close] option via the control-menu box at the top left corner of the window (or by pressing <Ctrl-F4>) or by selecting [Window] from the main menu and then [Close All] from the sub-menu.

6. GRAPHICS IN HYQUAL

Graphical output can be produced in HYQUAL by selecting the [Output] option of the main menu on the top bar menu, followed by [Graphics] on the sub-menu. Another sub-menu gives a choice of the graph type. The user can choose to work with time series, multi site, scatter or bar graphs. Graphs can display a maximum of 500 years of information and a minimum of twenty minutes. In extreme cases the user may find that the graph sent to the printer will contain too much information to be printed. However, it is anticipated that this will only occur when the number of data points are too numerous to be easily seen on the screen or hardcopy plots.

6.1 Time series graphs

Time series graphs give a visual description of the changes of levels of determinands with time. If the [Time Series] option is chosen, the dialog box, *Graphics information*, appears (figure 3.24, page 27).

A valid region, cluster type, cluster and sample point must be displayed in the appropriate boxes. A determinand may then be chosen, from the list provided, and assigned to either the Y1 or Y2 axes. The determinands are assigned to the Y1 (left side) axis or the Y2 (right side) axis, by clicking on a determinand in the list box, and then clicking on the appropriate [Y1-Data] or [Y2-Data] buttons. This action is recorded in the list box at the bottom left of the dialog box with a shortened description of the determinand and the axis specified. This description will be used as the default legend in graphical output.

Once a determinand has been assigned in this way, the legend may be changed from the default either by clicking on the shortened description in the list box and then the [Legend] button, or by double clicking on the shortened description. A text box is then provided for the legend required. The Y1 axis will be plotted on the right side of the graph, and the Y2 axis (if determinands are assigned to it) on the left side. Further determinands may then be chosen in the same way, either from the same sample point or from another valid sample point. Start and end dates and times for the graph must be entered through the appropriate text boxes.

6.2 Graph definition

When all the graphics options have been entered select the [Graph define] button. This displays the options available for customising the graphical output produced (figure 3.25, page 27). The text boxes in the Titles area of the dialog box will default to any previously entered settings but can be edited as required. The Options check boxes will be set to the default for the type of plot selected. The Axes information section is always blank initially.

The user can specify the main title and the titles of axes by clicking on the appropriate text boxes in the Titles area and typing the required text. It is recommended that the X-title be used to indicate the start and end dates of the graph.

The Options area has a range of choice boxes which may be switched on or off by clicking on them (a cross in the box indicates that it is on). Some choices are only appropriate for certain types of plot, and these will remain unavailable for other plot types. The function of each choice is described below.

Colour. The graphs will be more effective if produced in colour on the screen but it may be necessary to produce black and white plots on a hardcopy device for reports etc. For black and white output the different determinands are identified with different line types. Note that if a black and white plot with more than one determinand is

required it will be necessary to use lines, otherwise it will not be possible to distinguish between determinands.

Border. The border option will produce a border on printed output but will not display the border on the screen plots.

Grid. A grid may be plotted with this switched on, for ease of interpretation of graphs.

Auto scale. The auto scaling option provides scales which will incorporate the complete range of data to be plotted. Manual scaling may be input in the Definition of axes are, but the auto scaling must be disabled before it is possible to input the values required. The X axis options are usually automatically defined to incorporate the whole time series chosen therefore the X-Inc, X-Min and X-Max options remain disabled for time series plots (but see Y-Bar below).

Safe-L, Max and Min. These display the safe level and upper and lower limits that have been defined for each determinand plotted.

Y2 Bar. A histogram may be plotted on the Y2 axis (choosing Y2 Bar) if only one determinand has been assigned to this axis. This may be used in conjunction with Y2-Upward switched off to provide a realistic representation of rainfall on the time scale plot. If the histogram has been chosen then the manual axis definition will include the definition of the width of the bar to be plotted using the X-Inc choice. In this case one unit is either one day on the axis or one twenty fifth of the axis width, whichever is the narrower.

Symbol. The user can choose to plot data as symbols in the time series. Symbols will be placed at the position of stored values in time. The symbols will reflect the flags associated with the data (as entered by the user), and a key is supplied at the bottom of all graphs.

Lines. The user can choose to plot the time series with a continuous line for each determinand. Lines will be drawn to join adjacent, non-missing readings. Any combinations of symbol, line or both is acceptable for representation of the data, but with monochrome plots it will be necessary to include lines to distinguish between different determinands.

Miss-Value. Missing values will be identified on the graph with the standard missing symbol (an upturned empty triangle), otherwise they will be ignored.

Y2-Upward. The Y2 axis may be inverted by switching off the Y2-Upward box. This can be useful for displaying rainfall, for example.

In the Axes definition area, the range and increments required for the Y axes may be defined after the Auto Scale option has been turned off. The X-axis is always defined to cover the whole time series requested, and with suitable increments, so these options remain disabled for time series plots unless a histogram is being drawn (see above). Values for the y axes range and increments can be entered by clicking on the boxes and entering values required.

A graph definition can be saved to a named file through the [Save definition] button and recalled via the [Load definition] button. When the *Graph Definition* dialog box has been completed select the [OK] button to return to the previous dialog box and select [Process] to produce the graph. A valid time period must have been entered or the graph will return with an error message. An example of the printout is shown in figure 3.23 on page 26.

The time-series graph is extremely flexible, and can be used to plot any number of determinands in one plot, from the same or different sample points. This will allow the

comparison of different determinands, with time, at one sample point, and also the comparison of the same determinand at different sample points with time, as well as a combination of the two.

6.3 Multi site plots

It is possible to plot information from many sample points using the [Multi Sites...] option of the [Graphics] sub-menu. The dialog box provided for basic graphical information is identical to the one for Time series. A valid region, cluster type, cluster and sample point must be chosen prior to identifying a determinand of interest and assigning it to the Y1 axis. A new region, cluster type, cluster and sample point may then be defined, together with a new determinand. This can be repeated for many determinands from different sample points, and is particularly useful for tracing the change in a determinand along a river reach, for example. In this way determinands from different sample points can be compared.

When the graphics information screen has been completed select the [Graph define] button. This will display the options available to tailor the graphical output, and is similar to that shown in figure 3.25 on page 27.

The *Graph Definition* dialog box for multi-site plots is similar to that for time-series plots but there are some variations in the options available. These are described below. Some of the choices are only appropriate for certain types of plot, and these will remain unavailable for other plot types.

Log-X, Log-Y1 and Log-Y2. (These options replace the safe level and upper and lower limit options in the time-series plots.) The axes are only available with linear scaling in the multi-site plots so these options will remain disabled throughout.

HLC. (This replaces the symbol option in the time-series plots.) This is an important option for multi site plots as it switches between the two formats available. If HLC is switched on, the statistics (highest, lowest and average) of the determinands for the period requested are calculated, and a bar is drawn for the sample point displaying these three features. If HLC is switched off only the average of the determinands for the period are calculated, and these are plotted as a histogram for each of the sample points. For attractive HLC plots it is useful to set up Y1-Min and Y1-Max to provide a range outside the available data. In the case of multi site plots there is not the facility to use a different axis on the right hand side of the plot.

Axes information can be defined if the Auto scale option is turned off. The X-axis is always divided equally between the different determinands plotted and so the X-Inc, X-Min and X-Max are disabled for multi site plots. The range and increments required for the Y1 axes may be defined. It is suggested that for multi site plots the Y1 axis is defined manually to provide an attractive plot when HLC is switched on. Values for the Y1 axis range and increments can be entered by clicking on the boxes and entering the values required.

When this dialog box has been completed, and [OK] has been selected, the user is returned to the previous dialog box where [Process] can be chosen to produce the graph. A valid time period must have been used or an error message will be displayed.

6.4 Scatter plots

Scatter plots can be produced by choosing the [Scatter...] from the [Graphics] sub-menu. The scatter plot option allows the plotting of many determinand values against one dependent determinand from the same sample point. A linear regression is carried out between each independent and the dependent determinand, and this can be displayed on the

plot. A valid determinand must be chosen for the X-axis, by specifying a valid region, cluster type, cluster, sample point and determinand code, and assigning it to X-Data. Further determinands may then be chosen and assigned to the Y axis.

When the determinands have been assigned, the legend for the each may be edited by either clicking on the shortened description and then the [Legend] button, or by double clicking on the shortened description. A text box is then provided for the legend required. The Y1 axis is on the left hand side of the graph.

When the graphics information screen has been completed the [Graph define] button may be chosen to display the options available for customising the graphical output. Some options are only appropriate for certain types of plot and these will remain disabled for other plot types. The options for scatter plots perform in a similar way to those for time-series and multi-site plots with the following exceptions.

Log-X and Log-Y1. These can be selected to produce logarithmic scaling. (Note: Log-Y2 appears as an option but it is not available in this version of HYQUAL.)

Symbol. The user can choose to plot data as symbols in the scatter plot. Symbols will be placed at the position of stored values in time, indicating the distance from the line of linear regression. The symbols indicate the flag associated with each determinand value. At present it is necessary to use lines on these scatter plots to identify the relationship between different determinands when plotting a multi-determinand graph.

Lines. The user can choose to plot the line of linear regression by switching this option on

When the *Graph Definition* dialog box has been completed and the [OK] button has been selected, the user is returned to the *Graphics Information* dialog box where the [Process] button can be selected to produce the graph. If a valid time period has not been entered an error message will be displayed.

6.5 Bar graphs

Bar graphs are intended to provide a time series histogram plotting facility for one determinand at a single sample point, in either two or three dimensions, thus displaying the changes of levels of a determinand with time. If the [Bar graph...] option is chosen from the [Graphics] sub-menu the *Graphics Information* dialog box is displayed. Information is entered as for the previous graph types.

When the *Graphics information* dialog box has been completed select the [Graph define] button to display the options available for customising the graphical output. The Options area has a range of choices which may be switched on or off by clicking on the choice boxes. A cross indicates that the choice has been selected. Some choices are only appropriate for certain types of plot and these will remain unavailable for other plot types. The options for bar graphs perform in a similar manner to those for the other graph types with the following exceptions.

3D Bar. The histogram may be plotted as either a 2D or 3D representation using this switch. If 3D is chosen the plot will be clearer if the Cage option (see below) is also switched on.

Cage. Turning this option on causes a "3D" frame to be drawn around the plot area. It can make the 3D image appear more effective.

If the Auto scale option is turned off the Axes information area can be used to provide manual definition of the axes. The X axis options are automatically defined to incorporate the whole time series chosen, therefore the [X-Min] and [X-Max] options remain disabled

for bar graphs. However, the [X-Inc] option is available for sizing the width of the bars. The range and increments required for the Y1 axes may be defined by clicking on the Y1-Inc, Y1-Min, and Y1-Max boxes and entering suitable values. The Y2 axis is unavailable in bar graphs and so these options are turned off.

When all entries have been made on the dialog box select the [OK] button to return to the *Graphics Information* dialog box and select the [Process] button to produce the graph. A error message will be displayed if a valid time period has not been entered.

7. DATA IMPORT AND EXPORT

7.1 Importing data

It is often useful to be able to input data from ASCII files produced with other software packages or systems, rather than typing all data into HYQUAL manually. HYQUAL has an import facility to help with this. Select [Input] from the main menu and [Import data...] from the sub-menu. The import facility allows the definition of a valid sample point and then the import of determinand values into sample codes which either exist already or are new codes.

When [Import data...] is chosen, the user is prompted to enter the name of the ASCII file to import. The dialog box is as shown in figure 7.1. A file name can be either typed in or selected from the Files list box. When the file name has been entered and [OK] selected, HYQUAL will systematically work through the file, reporting its actions on completion.

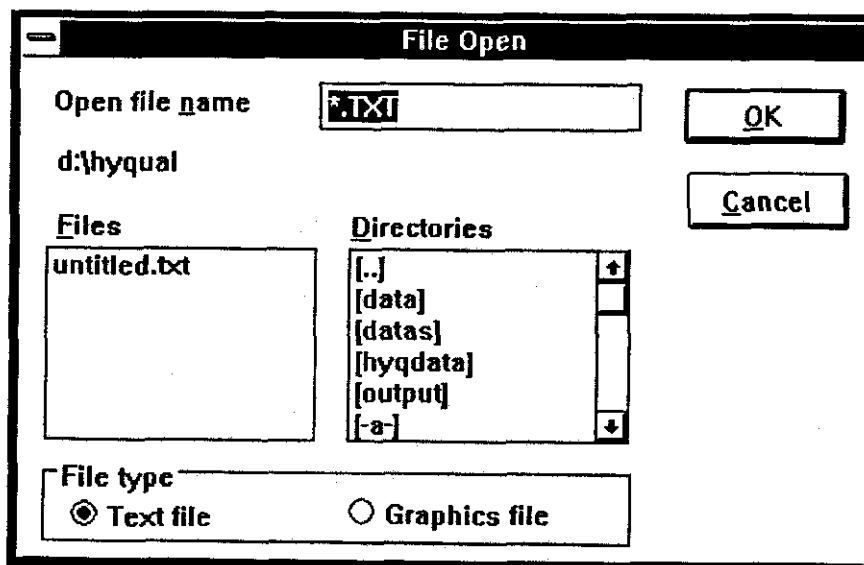


Figure 7.1

7.2 The Import ASCII file format specification

The ASCII file to be imported has to be formatted in a particular way, an example being the file TESTIMP.DAT provided with the package. The file is printed below for convenience.

TESTIMP.DAT:-

```
-----
SAMPLES
//
// This is a sample of an import file suitable for HYQUAL v1.0
// The first line must be an uppercase word SAMPLE as shown
// All lines with // are assumed to be comments
// Lines starting # are command lines
// The next line should define a valid cluster name
// providing the region name, cluster type and cluster name
//
#CL ANGLIA abstract cambridge
//
```

```

// Then the sample point code
//
#SP cam0001
//
// Flags for Default-Time, Data-Flag, Auto-Code, Code-Prefix
//
#FF TRUE TRUE TRUE TS
//
// Followed by the determinands list
//
#DT          BOC      BOD      Fe  Test      Cu      S  Must  Pb
//
// The determinand units and Date or Time if appropriate
//
#DU Date      ml/l      ml/l      mg/l  mg/l      mg/l      mg/l  mg/l  mg/l
//
// Finally the data
//
12/03/92 14.5G      2.3l  44.5S  7.8M  18.6N  2.3G  4.5l  3.0N
13/03/92 25.2      12.3  54.5  7.8N  28.6M  2.3N  4.5L  3.0G
14/03/92 42.2      3.3L  44.5L  7.8M  38.6M  2.3G  4.5  3.0
15/03/92 45.2M     8.3G  14.5  7.8  18.6  2.3  4.5  3.0S
16/03/92 32.2M     5.3  14.5  7.8S  28.6G  2.3L  4.5  3.0S
17/03/92 18.2      2.8G  44.5  7.8  38.6  2.3  4.5  3.0
18/03/92 10.2L     22.3L 14.5G  7.8S  28.6  2.3M  4.5M  3.0L
19/03/92 21.2      82.3G 24.5  7.8  28.6M  2.3  4.5M  3.0
20/03/92 11.2G     72.3G 34.5G  7.8S  18.6  2.3  4.5  3.0M
//
// The end of the file is identified with the following:-
//
#FE

```

An explanation of the format is as follows.

The first line in the file must be the upper case word SAMPLES.

Comment lines may be added throughout the file as required by the user. They are identified by // at the beginning of the line. Command lines are identified by having the character # at the start of the line. The two-character command following it must be in upper case in all.

The next command line for the import file must contain the #CL command for cluster, followed by the definition of the cluster with the region, cluster type and cluster name in free format. These names are not case sensitive, but they should be a valid region, cluster type and cluster name otherwise the import will abort at this stage and identify the non-valid name. In the example this line is

```
#CL ANGLIA abstract cambridge
```

which identifies a cluster cambridge, which is an abstraction cluster type in the ANGLIA region.

The third command line specifies a valid sample point with the line #SP cam0001. Again the actual sample point name is not case sensitive.

The fourth command line must contain four flags after the #FF command. The first three are either TRUE or FALSE and must be in upper case. These are as follows:-

Flag 1, if TRUE, assumes default times are to be assigned to the data. If FALSE is chosen the times must be entered immediately before the determinand values for each sample.

Flag 2, if TRUE assumes that a one character flag will accompany the determinand values,. If FALSE flags will not be expected.

Flag 3, if TRUE assumes that an automatic code is required for the sample code. This HYQUAL generated code will be made up of a two character code prefix flag, followed by the date of the sample. If FALSE, HYQUAL will expect to read the sample code as the first variable in the list of determinand values for each sample.

Flag 4. This last flag should consist of the two characters that are required to prefix an automatic code name for the samples.

The next command line should contain the #DT command followed by the list of determinands in the import file. In the example this line is:

```
#DT BOC BOD Fe Test Cu S Must Pb
```

The spacing chosen in the example is merely to provide easy to read table headings in the ASCII file, and is irrelevant to HYQUAL.

The #DU command line then identifies the Date and Time (if these are to be read in) together with a list of the units of the determinands. These units should be the same as the units assigned to these determinands in HYQUAL.

A list of the sample code, date, time (choose the appropriate ones according to the flags set) and determinand values should follow, with one line for each sample. A line may contain a maximum of 20 determinands. If more than 20 determinands are to be imported it can be done by importing several data sets, each having 20 or less determinands. Users wanting to import data sets having more than 20 determinands can split their files by using, for example, a spreadsheet or a suitable text editor. When data is imported into a sampling point that already exists in the database, HYQUAL will ask whether to continue with the import. If the import is not cancelled, any *existing* determinand values will be *replaced* by the new values in the import file, and values for *new* determinands will be *added* to the sample. In the example the date is the only thing that preceeds the determinand values as the flags have been set to indicate automatic time and automatic sample code generation.

The end of the file is identified by the #FE command.

7.2 The import report

When the filename has been entered and [OK] chosen, the file will appear on the screen and HYQUAL will work through each line, stopping either at the end of the file or before the end with an appropriate error message. When the import has been completed, either to the end of the file or to the identification of an error, a report called IMPORTED.REP is produced. An example of the report from the above import exercise is shown below.

```
IMPORTED.REP
```

```
-----  
SAMPLES
```

```
Data file title: SAMPLES
```

```
#CL ANGLIA abstract cambridge
```

```
Region      : ANGLIA
```

```
Clust type: ABSTRACT
```

```
Clust       : CAMBRIDGE
```

```
#SP cam0001
```

```
Sample Point: CAM0001
```

```
#FF TRUE TRUE TRUE TS
Use Default Time   : TRUE
Data follow by Flag : TRUE
Generate Sample Code : TRUE
Sample Prefix      : TS
```

```
#DT          BOC   BOD   Fe    Test   Cu     S      Must   Pb
Determinand: BOC Processed
Determinand: BOD Processed
Determinand: Fe Processed
Determinand: Test Processed
Determinand: Cu Processed
Determinand: S Processed
Determinand: Must discarded
Determinand: Pb Processed
```

```
#DU Date      ml/l   ml/l   mg/l   mg/l   mg/l   mg/l   mg/l   mg/l
  12/03/92    14.5g   2.3l   44.5S   7.8M   18.6N   2.3G   4.5l   3.0N
=====PROCESSED=====
  13/03/92     25.2   12.3   54.5    7.8N   28.6M   2.3N   4.5L   3.0G
=====PROCESSED=====
  14/03/92     42.2    3.3L   44.5L   7.8M   38.6M   2.3G   4.5    3.0
=====PROCESSED=====
  15/03/92     45.2M    8.3G   24.5    7.8    18.6    2.3    4.5    3.0S
=====PROCESSED=====
  16/03/92     32.2M    5.3    14.5    7.8S   28.6G   2.3L   4.5    3.0S
=====PROCESSED=====
  17/03/92     18.2    2.8G   44.5    7.8    38.6    2.3    4.5    3.0
=====PROCESSED=====
  18/03/92     10.2L   22.3L   14.5G   7.8S   28.6    2.3M   4.5M   3.0L
=====PROCESSED=====
  19/03/92     21.2    82.3G   24.5    7.8    28.6M   2.3    4.5M   3.0
=====PROCESSED=====
  20/03/92     11.2G   72.3G   34.5G   7.8S   18.6    2.3    4.5    3.0M
=====PROCESSED=====
```

#FE

```
RESULT: 9 Sets 7 determinands processed.
        1 determinands discarded.
```

As can be seen from the report, all the determinands have been processed except Must which was not defined as a determinand in HYQUAL before carrying out the import. The result is a set of sample information held in HYQUAL with the sample codes TS920312 to TS920320 as shown in the following sample code report from HYQUAL:

```
-----
HYQUAL V1.0                               Institute of Hydrology
-----
                        General Sample Report
-----
Code      Date      Time      A-Date      A-Time
-----
TS920312  12/03/1992  12:00:00  12/03/1992  12:00:00
TS920313  13/03/1992  12:00:00  13/03/1992  12:00:00
-----
```

TS920314	14/03/1992	12:00:00	14/03/1992	12:00:00
TS920315	15/03/1992	12:00:00	15/03/1992	12:00:00
TS920316	16/03/1992	12:00:00	16/03/1992	12:00:00
TS920317	17/03/1992	12:00:00	17/03/1992	12:00:00
TS920318	18/03/1992	12:00:00	18/03/1992	12:00:00
TS920319	19/03/1992	12:00:00	19/03/1992	12:00:00
TS920320	20/03/1992	12:00:00	20/03/1992	12:00:00

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The sample code names are made from the two letter code prefix specified in the #FF line together with the date expressed in YYMMDD format.

7.3 Export

Although there are very flexible reporting options throughout HYQUAL, it may still be useful to export determinand values in a standard format. The [Export] choice on the [Output] sub-menu is designed for this. The [Export] menu facilitates the production of an ASCII file with determinand values for samples at a valid sampling point. The format produced is complementary to the import format, so that this export file could be imported directly into another HYQUAL database using the [Import] command with no alterations.

Figure 7.2

If data are to be exported the [Export] option should be chosen, and the dialog box shown in figure 7.2 should be used to identify a valid sample point, i.e. a valid region name, cluster type, cluster and sample point.

The [Process] button is then selected to provide a further dialog box, *Data Selection* (figure 4.5, page 35). This allows the definition of the particular sample codes to be output, together with the list of determinand values. There are also a set of check box options in the centre of the screen which can be used to alter the output produced:

Sort code allows the user to sort the list of sample codes according to the sample code rather than the date and time of the sample.

Restrict allows the user to restrict the samples according to period of record, sampler, analyst or any combination of the three. The choice is defined in the *Sample Restriction* dialog box (figure 4.6, page 35).

No time removes the time of the sample from the list of output information.

No code removes the sample code from the list of output information.

No flag ensures that flags associated with determinand values are not output to the file of information.

These options are all switched off by default.

When all the options have been specified the [OK] button can be chosen and the ASCII file (EXPORTED.DAT) produced is displayed on the screen. This file can then be saved to a file name of the user's choice with the [File] choice from the main menu.

An example export file, EXPORT.DAT, from the information imported above is shown below.

```
-----
SAMPLES
// Region, Cluster-Type and Cluster (#CL).
#CL ANGLIA ABSTRACT CAMBRIDGE
// Sample-Point (#SP).
#SP CAM0001
// Default-Time, Data-Flag, Auto-Code, Code-PFX (#FF).
#FF FALSE TRUE FALSE
// Determinands and unit (#DT & #DU).
#DT
#DU Code      Date      Time      BOC      BOD      Cu      DIC
      ml/l      ml/l      mg/l      Mg/l
      TS920312 12/03/1992 12:00:00 14.5G    2.3L    18.6N    (miss)M
      TS920313 13/03/1992 12:00:00 25.2N    12.3N    (miss)M    (miss)M
#FE
-----
```

The similarity with the import example is readily identified. Each of the parameters in the command lines are as set out in section 7.1 (importing data) above.

The export process will identify any problems with an error message on the screen.

8. PASSWORDS AND SYSTEM MANAGEMENT

8.1 The System Manager

The HYQUAL System Manager program (SYSMAN.EXE) is a DOS program that must be run before HYQUAL can be used for the first time. The program runs automatically during the installation of HYQUAL. Its only purpose is to allow the first time establishment of a system manager name and password. Figure 8.1 shows the System Manager screen.

```

Welcome to the HYQUAL System Manager
HYQUAL Directory: █
To validate your System Manager status,
Please enter the following details:

SYSMAN ID :
Password   :                               Repeat:
Address    :
Telephone  :

Press <Enter> to validate or <ESC> to cancel
```

Figure 8.1

All of the fields must be completed. Leaving any field blank will cause the System Manager program to fail and the program will have to be run again. Pressing the <Esc> key will also cause the System Manager program to abort.

The System Manager program can be run at any time simply by typing SYSMAN at the DOS prompt. Doing this will add a new password and manager permission, but it will not overwrite any existing passwords or permissions. Because this could remove the element of security intended by the use of passwords and permissions, managers should consider deleting the SYSMAN.EXE file from the hard disk immediately after HYQUAL has been installed and tested. The original HYQUAL floppy disk should, of course, be kept in a secure place.

8.2 Passwords and permissions

Before any data can be entered or edited, HYQUAL users must first log on with a user name and password. Users can be assigned to one of four groups, or permissions, according to the level of access required.

Start HYQUAL and then log on by clicking on the [system] menu, then on the [Logon...] choice in the sub-menu. The *User Information* dialog box appears (figure 3.2, page 11). Users must enter their name and password, each of which can be up to nine characters in length, and click on the button representing the user group assigned to them. Only users with a permission level of "Manager" can add or edit permissions at lower levels.

Users with a permission level of Manager or Group A have unrestricted access to all of the HYQUAL menus. Users in Groups B have restricted access to menu choices in the

[system] menu. Users in Group C have no access to choices in the [system] menu. The table below summarises the menu access available to each user group.

	<i>Manager</i>	<i>Group A</i>	<i>Group B</i>	<i>Group C</i>
Regions	✓	✓	-	-
Cluster types	✓	✓	-	-
Cluster	✓	✓	-	-
Sample types	✓	✓	✓	-
Determinands	✓	✓	✓	-
Samples	✓	✓	-	-
Analysts	✓	✓	-	-
Laboratories	✓	✓	-	-
Options	✓	✓	-	-

Names, passwords and user group permission levels cannot be deleted. The only way to prevent an existing user from gaining access to HYQUAL is to change the user name and password. Any user with permission level of Manager can do this by clicking on the [system] menu then on the [Log on...] choice to display the *User information* dialog box (if already logged on, first click on [Log off]). Next click on the [New] button, then on the required user name (via the User list box), edit the user name and password and finally click on the [save] button.

A record of user access to HYQUAL (including failed attempts) is stored in an ASCII file called USER.LOG. This can be used by a system manager to monitor access and usage of HYQUAL. The file will increase in size with use and should be either deleted or edited with an ASCII file editor (the Windows Notepad is suitable).